# Gas Journal

SEPTEMBER 8, 1937

Vol. 219 89th Year No. 3877

## Editorial Notes

### Public Lighting

UNDER the Presidency of Mr. C. I. Winstone, Public Lighting Superintendent to the Gas Light and Coke Company, the Conference of the Association of Public Lighting Engineers at Folkestone is in full swing. The attendance constitutes a record and the organization has left nothing to be desired. As in former years, the programme has been mapped out to provide equal interest to the gas engineer and to the electrical engineer. This applies to the Papers presented and also to the magnificent display of street lighting, which is attracting a great deal of public attention and admiration. In this display gas is making a very fine showing indeed, demonstrating "clearly" enough that gas is not destined to be overshadowed by electricity. The Gas Industry is fully capable of planning street lighting scientifically, and the combined efforts of the Industry and the manufacturers of lighting equipment have resulted in a vast improvement in the performance of the wide range of fittings now available.

This improvement is for all to see at Folkestone this week, and the demonstration should not only give renewed inspiration to the gas delegates attending the Conference, but should convince anyone responsible for local administration that gas is the very reverse of a back number for the adequate illumination of our highways under modern and most exacting conditions. To make this display the huge success which it undoubtedly is, the manufacturers of lighting equipment have collaborated wholeheartedly with Mr. Winstone and Mr. G. le B. Diamond, of the Folkestone Gas and Coke Company, who were responsible for the work entailed. On later pages we give a descriptive account of the demonstration lighting, which is not a mere series of "stunts" or exhibitions of brilliance of illumination, but a practical showing of gas lighting applicable to the requirements of the particular thoroughfares in which the units are erected. The photographs we reproduce—and these are not photographs "touched up" for the occasion—tell their own story of the effectiveness of gas when correctly applied to the lighting of streets.

In regard to the application of light to the street, with the object of ensuring safety, Mr. Winstone had a good deal to say in his Presidential Address, and he referred particularly to the British Standards Institution Specification and the vexed question of road brightness *versus* test point illumination—a matter which has caused more controversy than any other in connection with public lighting. We have maintained in these columns that to regard surface brightness as the sole criterion of good street lighting is wholly mistaken. Admittedly road surface brightness is an important factor in assisting silhouette vision and producing brightness contrasts by which obstructions are seen on roadways, but the theory must be applied in practice judicially and with a full recognition of other factors involved in good street lighting, and with an appreciation of the varying needs of the different classes of road user. No two thoroughfares have precisely the same requirements, and the lighting installation must be designed having regard to the peculiarities of the particular thoroughfare. As Dr. S. English, of the Holophane Research Laboratory, emphasized in a Paper to the Illuminating Engineering Society last March—and he reiterated his observations in a Paper at the A.P.L.E. Folkestone Conference yesterday—the aim of street lighting is not to produce uniform illumination along the roadway, or to produce uniform and high surface brightness, or to eliminate glare, or to produce a constant degree of glare, but simply to enable road users of whatever class to see clearly whatever they need to see.

### The Depreciation Factor

MR. WINSTONE is with us in urging that too much consideration should not be given to test-point illumination. It is possible so to focus the light from a lamp that it will give the test-point illumination asked for in a tender and yet the lighting may be most unsatisfactory. And in

regard to the B.S.I. Specification Mr. Winstone criticizes not only the specified test point but also the 50% depreciation allowed, an allowance which tends to cause the maintenance of installations to be neglected. Undoubtedly by far the most important factor influencing luminous output is the quality of the general maintenance work. In general, provided a mantle is undamaged, the full lighting value of the burner can be restored by removing the mantle, cleaning the burner, and replacing the mantle. Experience over a number of years has shown that in the case of high-pressure lamps under good maintenance a depreciation factor of from 25 to 30% is an ample allowance. For low-pressure lamps under good maintenance a lower depreciation factor than 25% can probably be secured. The Gas Industry does not require a 50% depreciation clause in a lighting specification. Manufacturers of gas lighting apparatus supply us with good equipment, the perfection of which has cost them large sums of money; surely installations should be so maintained that they do credit to the men who made the lamps and fittings and reflect credit on the illuminant employed. In this maintenance work we would urge the frequent use of some form of portable photometer. Experience of those who employ photometers for ensuring that installations are being kept in first-class condition shows the effort to be well worth while.

## A New Development

We have spoken of the vast improvements which have been made in gas lighting equipment in recent years. A new departure in low-pressure gas lighting was the subject of a Paper at the Conference by Mr. George Keith, whose pioneer work in gas lighting has been of such value to the Gas Industry and to the community. A high tribute to the great services which Mr. Keith has rendered to the Gas Industry for nearly forty years was paid in another Conference Paper by Mr. Dean Chandler, who dealt with street lighting by the high-pressure system. That gas lighting is by no means the back number which some are inclined to believe is well illustrated in a table in Mr. Chandler's Paper which shows the steady progress of gas lighting in the streets of South London over a period of years. Most of the important main roads in South London are lighted with high-pressure incandescent gas lamps, and of the 2,700 high-pressure lamps now in use in South London, lighting nearly 73 miles of roads, 1,800 are of the " Supervia " type. As instancing the improvement in the efficiency of the lighting equipment, it may be mentioned that in South London the candlepower per cubic foot of gas consumed per hour has been raised from 25 in 1930 to 42·5—the latter figure relating to the year 1936.

The new lamp described at the Conference by Mr. Keith is a highly interesting development in low-pressure lighting. Contrary to the practice in normal low-pressure lamps, no secondary air is allowed to enter the globe. Instead, by an ingenious arrangement of syphon tubes, secondary air is " pushed " to the burner at a pressure slightly above atmospheric and sufficient to overcome the resistance of the mantle. Mr. Keith gives a figure of 800 lumens per cubic foot of 500 B.Th.U. gas for this lamp, which is a truly remarkable performance. The new lamp is an example of what is being done by the manufacturers of lighting equipment to strengthen the gas lighting load; and with such developments there is no need for pessimism regarding the part which gas will play in the future in the illumination of our streets.

## Thin Tar Carpets

Recently the South Metropolitan Gas Company has been engaged in experiments connected with the development of thin carpets containing tar as binder, these carpets constituting an important modern development in road treatment which is becoming increasingly popular. A thin carpet is a mixture of aggregate and binder normally applied in a layer about one inch thick to a stable road surface with the primary object of providing a non-skid surface requiring no further treatment for at least three years. Its use avoids the scattering of stone by traffic and the bleeding of binder which sometimes occurs with surface dressings, and it has the great advantage that it can be used to restore the good riding properties of a road which has become mis-shapen, without resorting to reconstruction. The first step in tackling the problem was to draw up a specification for thin carpets, based on work in the laboratory, before large-scale trials were attempted. How this was arrived at is described in a publication, " The Preparation of Thin Tar Carpets," just issued by the Company, and the publication, a model of its kind, discusses the physical properties of tar and road-stones, the commercial development of Metro Veneer carpets, and the results given by the carpets.

Road trials of Metro Veneer carpet were commenced in February of 1935, so that none of the material has yet been subjected to weather and traffic for three years. The two years during which most of the carpets have been in service, however, were abnormally wet; and, states the report, " that the majority of Metro Veneer carpets are still in satisfactory condition and appear capable of giving at least three years' life would therefore seem to justify the belief that successful thin tar carpets of the rough surface type can be made without difficulty." The report frankly states that success has not been invariable, and a few of the carpets have developed defects; a small percentage of failures, however, was to be expected in view of the rapidity with which the manufacture of the carpets has developed. The report of the South Metropolitan Gas Company explains that insufficient time has yet elapsed for definite conclusions to be drawn from the experiments, but it is felt that it has been established that satisfactory gravel aggregate carpets—and defects have been confined almost entirely to carpets in which gravel has been used—can withstand heavy traffic for three years without becoming seriously affected.

As an indication of the nature of the experiments, we may mention that since August, 1935, thin tar carpets to the Company's specification have been manufactured by two county councils and five firms of contractors and have been laid by fifteen different public authorities. A total quantity of about 30,000 tons of carpet has been laid, equivalent in surface area to some 50 miles of road. Many types of aggregate have been used and carpets have been laid on all types of road and on a variety of surfaces. The problem of the preparation of satisfactory tar carpets is a most important one, and while, as we have said, insufficient time has elapsed for the drawing of definite conclusions, this report of the South Metropolitan Company is bound to be of great assistance to others undertaking similar experiments. The experimental and commercial work described in the report—to which we intend subsequently to refer in more detail in the " Journal "—certainly shows that in this new development, as in other branches of road construction and surfacing, tar can maintain its position as an important modern road binder.

## Competition from Coal

In the "JOURNAL" for Aug. 25 we suggested in these columns that the future will see more determined efforts on the part of the coal industry to push the sale of raw coal in the domestic and the industrial markets, and we called attention to the way in which they are organizing to this end. We mentioned that the interest of the coal owners is being increasingly directed towards the utilization of coal as distinct from its mining, and that this province embraces such questions as the perfecting of marketing organization, the training of salesmen, and the collection of trade statistics. We suggested that the Coal Utilisation Council and the Combustion Appliances Manufacturers' Association were busy at work in the endeavour to persuade domestic and industrial consumers that raw coal is the fuel to satisfy their needs. In our Correspondence columns to-day Mr. J. G. Bennett, Director of the latter Association, states that his organization is a technical and not a propagandist body, and that it has no bias in favour of raw coal as against smokeless solid fuel. We are glad to have this assurance, though it does not affect our general argument that competition from raw coal will become keener, and that it is necessary that we should approach the heating problem from the all-in fuel cost and offer gas for additional use at prices competitive with those appertaining to the use of raw coal.

Mr. Bennett states in his letter that while gas is admittedly the nearest approach to the ideal fuel, the cost of manufacture and distribution must always make it more expensive than raw coal. This statement is, of course, far too sweeping. One has only to consider for a moment conditions of use and the different purposes for which fuel is required. For intermittent heating gas is demonstrably cheaper than raw coal or even coke, and this at gas prices round about 8d. a therm. It has been shown that in a colliery area, where a consumer takes advantage of a two-part tariff for gas, he can displace coal entirely and enjoy all the benefits of gas service with no greater annual fuel bill. Again, developments in gas appliances will enable gas to be used for auxiliary heating fluelessly. We discussed this question in the "JOURNAL" for Aug. 11, mentioning the availability of small independent gas heating units serving to take the chill off the air and acting as a complementary source of heat to the radiant gas fire. Employment of these low gas rate appliances—and their possibilities, granted that they are judiciously employed with due regard to gas quality, are vast—is tantamount to a reduction in the price of gas of something like one-half. Where a two-part tariff for gas is in operation—and there is, fortunately, a spreading acceptance of attractive tariffs—these unit heaters constitute the most economical form of heating.

In the editorial note to which Mr. Bennett refers in his letter we mentioned the broadening of research in the coal industry. Among the latest moves in this connection is the institution of a special course, leading to the Degree of B.Sc. in Coal Utilization, at the University of Birmingham. The object of this course is "to train young men of sound general education in the processes connected with the treatment of coal, its use, and the economic factors involved in marketing the finished product." The course, which extends over three years, is "designed throughout to supply a comprehensive training in treating and marketing fuels under modern conditions of supply and demand," and students will be required to supplement the lectures and laboratory work by attendance during their vacations at power stations, coke ovens, gas-works, steelworks, and with the organizations which deal with factoring and exporting coal. The establishment of the Birmingham course coincides with a far-reaching scheme for the organization of research in the coal industry, and it is obvious that the effect of the training will in time be felt throughout all branches of the industry and particularly, we think, the utilization side, on which so much energy is being concentrated. It will be noted that, in setting out the object of the course reference is made to the marketing of the "finished product." What exactly is implied by that we do not know, but gas and coke are "finished products" of coal, and we think that the students taking the course who spend their vacations at gas-works and coke ovens will quickly appreciate that the future lies with "finished products" rather than raw coal.

## Transport by Solid Fuel

In many European countries it has become realized that solid fuel can be used for motor transport by means of producer gas. A small suction gas producer is carried on the vehicle, the fuel used being charcoal, anthracite, or semi-coke. Up to the present it does not seem to have been found possible to use high-temperature coke satisfactorily, but that is a problem which might be solved by research, and we suggest that some of the research activity of the Gas Industry might be turned in that direction. A demonstration was staged lately of two such vehicles, one using charcoal, and the other low-temperature coke. A prime requirement is that the fuel should be free from tar, and a second is that it should be of high combustibility. The fuel was charged into the generator cold, and a little waste soaked in paraffin was placed at the air intake. A match was applied to the paraffin, a few seconds later the fan was started, and within less than two minutes from lighting up from the cold the vehicles moved off on their journey. No petrol or fuel other than the charcoal or semi-coke was used throughout the whole operation. As a demonstration of a method of using coke to take the place of oil the process was very striking. We understand that hundreds, if not thousands, of French army vehicles are thus equipped, and so are many in Germany, Russia, and Italy. In Germany a subsidy of £50 is paid to every carrier adopting a producer plant. These plants can also be applied to motor boats and other forms of transport, including farm tractors.

The cost of running on solid fuel is important. In introducing the demonstration, the Duke of Montrose explained that last year a 4-ton lorry ran with a load of concrete, the weight of lorry and load being 7 tons 7 cwt., from London to Edinburgh, a distance of 393 miles, at a total cost for fuel of 8s. 9d., equal to 43 miles of journey for each shilling spent. The cost of a similar lorry and load run on petrol would be £3 and on diesel oil £1 10s. In the behaviour of the engine and vehicle, he said, there was nothing at all to distinguish and differentiate the running conduct from an ordinary petrol-driven vehicle. The distance run by the vehicles of the London Transport Board in a recent year was 250 million miles. "I believe," he continued, "that the average distance per gallon of petrol is 5 miles. The requirements in low-temperature coke would be 2 lb. to the mile, or a total of 500 million lb., which at £2 a ton would cost £450,000 a year, compared with the cost on petrol at 1s. a gallon of £2,500,000 a year, or, on diesel oil, say, £1,250,000 a year. In economy of running and in wear and tear this solid fuel type of engine is not ashamed to face all comers. Of course, you will at once recognize the advantage from

the point of view of exchange if a country can produce its own fuel instead of importing it from abroad. There is also the direct bearing on the unemployment question; surely it is better to find work for our coal miners than to send money out of the country and pay for doles at home."

This is the case for the coke-fired producer type of heavy transport vehicle. That it is not experimental is clear from what has been done in foreign countries. Other cost balances have been published which confirm the figures given by the Duke of Montrose. The Gas Industry might well pay attention to this system. It might be found possible by research to use gas coke in the generator; if not, it might be possible to activate gas coke for the purpose; and if even that were impossible, it is conceivable that the production of gas in a process that provides a suitable semi-coke might be feasible, though, of course, if gas coke were not suitable, or could not be made suitable, the Gas Industry would have less interest in the idea.

# CORRESPONDENCE

## *Use of Raw Coal*

SIR,—In a leader in your issue of Aug. 25 you state that this Association is "busy at work in the endeavour to persuade domestic and industrial consumers that raw coal is the fuel to satisfy their needs."

I should like to emphasize that we are a technical and not a propagandist organization, and that in any case we have no bias in favour of raw coal as against smokeless solid fuel. A large proportion of our members manufacture coke-burning appliances, and we fully recognize the immense part which coke has played and will play in the future in the domestic market.

I should, of course, be far from denying that it is our principal aim to improve coal and coke burning appliances and increase their competitive power. While gas is admittedly the nearest known approach to an ideal fuel, the cost of manufacture and distribution must always make it more expensive than raw coal, especially when the present disparity between the selling price of domestic and industrial coal disappears. For this reason it seems to us that the domestic market will always involve a balance between gas, electricity, and coal as sources of heat, and that this balance should not be disturbed by accidental factors such as disparity in the efficiency of equipment.

Yours, &c.,
J. G. BENNETT,
Director.

*Combustion Appliance Makers' Association,*
*54, Victoria Street,* S.W. 1,
*Aug.* 31, 1937.

## *Modern Trends*

SIR,—There is a tendency nowadays to take stock of the general position in the Gas Industry and to question the value of some theses which have hitherto been regarded as axiomatic. Among these has been the acceptance of the fact that due attention to the manufacture of suitable coke as a chief by-product was one of the essentials to attain a low cost of gas into holder. There have been two fundamental bases for this conclusion; one is the apparently reasonable belief that properly prepared coke ought to command a price per ton at least equal to the cost per ton of coal into the carbonizing plant, and the other reason is that processes involving complete gasification, or the partial gasification of the coke by steaming, employ the water-gas reaction, which is highly endothermic and so requires an input of heat, whether by "air blowing" or by heat passage through the walls of carbonizing chambers during steaming, which is much higher per therm of water gas made than that required to release "straight" therms of gas in plain carbonization.

If we needed reassurance on the first point—*i.e.*, the question of the advisability of producing coke—the boldness of the low-temperature carbonization people ought to suffice, in that they appear to have faith in a future expanding market for a coke which they sell at prices per ton much in excess of the cost per ton of coal into retorts. The production of suitable domestic coke in high-temperature carbonizing plant has been discussed almost *ad nauseam* in recent years, and we have been made abundantly aware of those policies by which this end could be achieved. For example, quite apart from the question of prior blending of coals and the careful quenching, cutting, and sizing of the coke produced, it has been clearly shown how grates could be modified or substituted by special designs and provided with gas lighting burners, all with a view to burning gas-works and oven coke with ease. There have also been evolved grates like the C & C (coke and coal) in which the smokelessness and ignitability of low-temperature coke are attained merely by the use of a sized mixture of coke and coal, while on a somewhat analogous plane there has been the production of coke in narrow ovens which is discharged with a "mourning band" down the middle—*i.e.*, a little while before the charge would have been carbonized right through (a policy possible with non-swelling coals, and practised in America at least eleven years ago).

Low-temperature coke still represents only a very small proportion of the solid fuel used here, though admittedly in its lesser sphere there has been a somewhat spectacular activity of late, but what now exercises the minds of high-temperature coke producers, when looking ahead, is not the incursion of low-temperature coke but the possibilities arising from the changing habits of the population, and the increasing demand, even among the poorer classes, for the more convenient and labour-saving heating by gas and electricity. Anyway it is some consolation to know that in the event of a falling off in the market for coke, even coke ovens can be used for water gas production by steaming—*e.g.*, as in the Collin oven-coupling system—while intermittent vertical chambers which are in many ways analogous to coke ovens might be used, as I ventured to suggest in a Paper before the Third International Bituminous Coal Conference at Pittsburgh, 1931, for a species of total gasification.

Estimated output and costs were given in some detail for the total gasification cycle in intermittent vertical chambers, the calculations being made on the assumption "that steaming is continued until the residue of coke (925 lb.—*i.e.*, 8¼ cwt. per ton of coal charged) is only just sufficient to supply the producers for the whole period of carbonization and steaming." In such circumstances total gasification implies 10 hours for carbonization and 24 hours subsequent steaming—*i.e.*, a 34-hour charging cycle. The yield of gas per ton would be 50,229 cu.ft. of a calorific value of 352 B.Th.U. per cu.ft., or 176·85 therms per ton. The water gas, if collected in a separate main, would amount to 37,000 cu.ft. per ton, or 104 therms. "As compared with straight carbonization, total gasification in vertical chambers results in an increase of charging cycle from 10 to 34 hours—*i.e.*, in a reduction of coal throughput to about one-third normal. On the other hand, the volume output of gas from the plant is increased by about 14% and the gaseous therms reduced by about 27% on a daily basis." The net cost of the gas was estimated as 1·712d. per therm as compared with 0·879d. for 540 C.V. gas by straight carbonization in the same plant. Cost figures were also given for 510 and 480 C.V. gas, which were 1·101d. and 1·252d. per therm respectively, and this recalls the second point in my first paragraph—*i.e.*, that steaming is theoretically uneconomic as compared with straight gas production. In connection with the greater heat input required for water gas therms it should also be remembered that the inevitable accompanying losses by radiation and conduction from the plant are proportionately increased.

However, perhaps in the end we shall be forced to produce less coke and resort to more steaming, though in theory it is less efficient. The electrical industry forges ahead and takes joint toll with the Gas Industry in the displacement of raw coal, and this it does despite the manifest inefficiency of electricity generation, which is still not higher than 30% on the coal-to-switchboard basis, as compared with a figure of about 80% for the efficiency of carbonization. But electricity generation may not always be so inefficient; at present much of the energy dissipated at power stations appears to be lost as "low grade" heat in cooler and condenser water—*i.e.*, in warming up rivers and the air which ascends cooling towers. Electricity is in an analogous stage to that of gas in its first fifty years of production in that people want it for certain purposes

and mean to have it, even if it is inefficiently produced. May I venture the suggestion that gas, in addition to its high efficiency of production, can now also make boast of modernity in the improved ways in which it can replace raw coal in these labour-saving days, and that Mr. Masterman sounded the keynote in his recent assertion that gas undertakings are becoming increasingly purveyors of "service" in the heating and lighting field perhaps even more significantly than they are purveyors of a commodity.

Yours, &c.,

L. H. SENSICLE.

*96, Seaforth Gardens,*
*Stoneleigh, Nr. Ewell,*
*Surrey.*

# Personal

Mr. R. DUDLEY PENDERED has been appointed a Director of the Wellingborough Gas Light Company to fill the vacancy caused by the death of Mr. T. E. Gravely, the senior member of the Board.

* * *

Mr. G. E. CHILDS, Engineer, Manager, and Secretary of the Ferndale Gas Company, Ltd., has been appointed Deputy Engineer and Manager of the Barry Gas Department. The position was rendered vacant on the appointment of Mr. R. L. Aspinall as successor to Mr. T. E. Franklin, whose retirement was announced in the "JOURNAL" for July 28.

* * *

We learn that among the recipients of the Coronation Medal in New Zealand was Mr. F. W. J. BELTON, Engineer to the Christchurch Gas, Coal, and Coke Company, Ltd.

# Forthcoming Engagements

Sept.

9-10.—NORTH BRITISH ASSOCIATION.—Annual Meeting at Edinburgh.
14.—N.G.C.—Central Executive Board, 2.30 p.m.
15.—I.G.E.—Finance Committee, 10 a.m.; Membership Committee, 11 a.m.; Research Executive Committee, 2.30 p.m.
16.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Porthcawl.
16.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Refractory Materials Joint Committee, 2.30 p.m.
17.—I.G.E.—Joint Lighting Committee, 2.30 p.m.
20.—LONDON AND COUNTIES COKE ASSOCIATION.—Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.
23.—S.B.G.I.—Council Meeting, 11 a.m.
26-29.—B.C.G.A.—Annual Conference at Manchester.
30.—I.G.E.—Gasholder Committee, 2.30 p.m.

Oct.

1.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
5.—I.G.E.—Research Executive Committee, 2.30 p.m.
5.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Commercial Meeting at Gas Industry House, 2.30 p.m. Discussion on Gas Mixing. Committee Meeting, 12 noon.
7.—I.G.E.—Joint Committee on Complete Gasification under Pressure, 3 p.m.
8.—NORTH OF ENGLAND ASSOCIATION.—Autumn Meeting at Willington.
12.—I.G.E.—Board of Examiners, 10.30 p.m.
13.—I.G.E.—Finance Committee, 9.30 a.m.; Membership Committee, 10 a.m.; General Purposes Committee, 11 a.m.; Benevolent Fund Committee of Management, 12.30 p.m.; Council, 2.30 p.m.
14.—EASTERN COUNTIES ASSOCIATION.—Autumn Meeting at Bedford.
19.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Gas Education Committee, 2.30 p.m.
26.—B.C.G.A.—Eastern District Conference at Lincoln.
27.—B.C.G.A.—Northern District Conference at Darlington.

Nov.

2.—I.G.E.—Council, 9.30 a.m.; Council (*continued*), 4.30 p.m.
2 and 3.—I.G.E.—Autumn Research Meeting.
3.—BRITISH GAS FEDERATION.—Annual General Meeting and Dinner, Grosvenor House, Park Lane, W. 1.

# In This Week's "JOURNAL"

## The A.P.L.E. Conference.

For the Annual Conference of the Association of Public Lighting Engineers, the town of Folkestone has been turned over to a practic l demonstration of all that is latest and best in street lighting and floodlighting. We reproduce in our review photographs of the gas installations, which we have no hesitation in saying will surprise the Gas Industry as well as the layman, so astonishingly good are the results obtained from them.

See p. 582.

### Presidential Address of C. I. Winstone.

In the course of his Presidential Address to the Association, Mr. C. I. Winstone, Public Lighting Superintendent of the Gas Light and Coke Company, draws attention to the great advances made in the field of public lighting during the last thirty-eight years. After dealing with lighting costs per mile, Mr. Winstone goes on to deal with road brightness and interpretation of the B.S.I. Specification, the provision of good visibility, and the importance of maintaining fittings in a clean state.

See p. 589.

### High Intensity Gas Lamps.

Modern incandescent gas lamps of the inverted mantle type operate on two distinct principles, the difference being of very considerable importance, states Mr. G. Keith in the course of his A.P.L.E. Paper on "High Intensity Gas Lamps." The amount of light which can be obtained from a given quantity of heat largely depends upon which of the two principles is used. In the one case the air-gas mixture contains only a proportion of the oxygen that is required for combustion, a secondary supply being required to complete combustion of the gas on the outer surface of the gas mantle fabric. In the other case, the whole of the oxygen required for complete combustion is mixed with the gas, the heat produced by its combustion being liberated wholly within the mantle. With the first system a secondary supply of air to the mantle is essential. With the second system a secondary supply of air is unnecessary and may be detrimental owing to its cooling effect. It has been found that when the whole of the products of combustion are passed through the meshes of the mantle, particularly at a high velocity, not only is the intensity of the light emitted, per unit area of mantle surface, much greater, but the amount of light produced from a given volume of gas is also greater. Mr. Keith describes a system which requires no mechanically operated booster and operates on low-pressure gas.

See p. 592.

### High Pressure Street Lighting.

In his Paper to the Annual Conference, Mr. Dean Chandler, of the South Metropolitan Gas Company, gives an interesting review of the evolution of the High Pressure Gas Lamp. The important stage in this development, he states, dates from the time when the gas pressure was raised to about 8 in. water gauge by mechanical contrivances, the object of which was to increase the velocity, and, therefore, the kinetic energy, of the stream of gas issuing from the gas nipple orifice into the mixing tube of the burner. After paying tribute to the work of Mr. George Keith, Mr. William Sugg, and others in the field of high pressure gas lighting, Mr. Chandler goes on to describe the development of the application of the system to the streets of South London, where the South Metropolitan Gas Company now have a total length of 119 miles of mains in their high pressure system for public lighting. The rapid development of the high pressure system has resulted in the interconnection of all but three of the Company's ten compressor stations.

See p. 598.

### Slagging of Refractories.

In an interesting article on this subject, contributed by Dr. G. E. Foxwell, it is suggested that, although it would be unprofitable to attempt any calculations of penetration based on assumed values for the surface tension of coal ash slags, attention should be devoted to this method of attacking the problem of slagging of refractories.

See p. 606.

### Sales Policy.

Before the Annual Convention of the Canadian Gas Association at Ottawa on June 10, Mr. G. W. Allen, Gas Survey Engineer, Toronto, delivered a Paper on "Practical Advertising and Salesmanship," in which he calls for advertising which creates a *favourable* impression and for salesmanship full of enthusiasm.

See p. 611.

# News in Brief

CURRENT EVENTS IN THE GAS INDUSTRY

**A Showroom** is to be opened at Beeston by the Nottingham Gas Department

**The North of England Gas Managers' Association** are holding their autumn meeting at Willington (Co. Durham) on Friday, Oct. 8.

**Applications Are Invited** for the position of Technical Assistant and Chemist by the Loughborough Gas Department. Further particulars of the position appear elsewhere in this issue.

**The Tender** of Messrs. Newton, Chambers and Co., Ltd., Sheffield, to supply four oxide purifiers for the Tradeston Gas-Works, has been recommended for acceptance by the Glasgow Gas Committee.

**A Bulk Supply** to Airdrie by the Coatbridge Gas Company is to be the subject of a financial report by the Town Chamberlain of Airdrie on a statement prepared by Mr. Archibald Kellock, Engineer and Manager of the Airdrie Gas Department, before any recommendation is made to the Town Council.

**Several Thousand Excursionists** who crowded Largs railway station on Sept. 5 boarded their trains by light provided by the headlamps of motor cars standing at the end of each platform. The town was "blacked out" for several short periods and finally for an hour as a result of an electricity failure.

**The Eastern Counties Gas Engineers and Managers' Association** are holding their autumn meeting on Thursday, Oct. 14, at Bedford. The business meeting, which commences at 11 a.m., will be held in the hall of the Social Club of the Bedford District Gas Company, and after luncheon the members are to inspect the works of the Le Bas Tube Company, Ltd.

**When So Much Was Heard** of the increased cost of living, it was of interest to note that as the result of expansion of business and improved organization and research the Gas Industry had achieved remarkable results, and in Cork the cost of gas supplied through slot meters was only 2½% above the pre-war figure, said Mr. E. T. Mahony, presiding at the general meeting of the Cork Consumers' Gas Company.

**Despite the Increased Coal Cost,** the price of gas will remain unchanged in Aberdeen during the coming year. The estimates of the Gas Undertaking for 1937-38, which were submitted at a meeting of the Gas Committee on Aug. 31, showed that coal will cost £17,407 more than it did during the previous year. The estimated expenditure for the Undertaking during the year was £270,529, as compared with an expenditure of £265,122 last year.

**Excellent Publicity** was obtained for gas-operated refrigerators last week by the striking exhibit of the Hastings and St. Leonards Gas Company in the two-mile procession which was a feature of the annual hospitals carnival. The tableau consisted of two gigantic polar bears eating ice cream cornets in an elaborate ice scene, and it received considerable applause from the vast crowd of spectators lining the route. The tableau won first prize in the class for "Local traders' decorated lorries."

**At the Annual Meeting** in Glasgow on Aug. 31 of Messrs. William Baird & Co., Ltd., coal and iron masters, Mr. A. K. M'Cosh, in the course of his remarks to the shareholders, said: "It must be a matter of great regret to those who understand how essential it is that a proper foundation should be laid now for the iron and steel industries in Scotland that the importance of an outlet for coke oven gas should not yet be appreciated. The special committee to which your Chairman referred in his remarks last year duly made its report, and its conclusions are very definite as to the advantages which would accrue both to the consumers of gas and to the iron and steel industries in this district from an arrangement to use this gas for general domestic and industrial purposes. In view of the fact that it has not yet been possible to secure a market for the gas, our scheme for the modernization of the Gartsherrie furnaces and the erection of coke ovens there is still in suspense."

**An Increase** in the price of gas by 5d. per 1,000 cu.ft. is intimated by the Directors of the Jedburgh Gas Company. This is due to the higher cost of coal and production.

**A Striking Display** at the Timaru Winter Show was the stand of the Timaru Gas, Coal, and Coke Company, Ltd. One-half of the exhibit was fitted as a model sitting room in which there were a Wright's panel fire, Sugg's chromium plated lighting fittings, and a Parkinson "Ubic" radiator. The other half of the stand was fitted as a model kitchen in which there were a streamlined "Champion" cooker (made in New Zealand by Radiation Ltd.), "Mercer" storage water heater, "Vale" copper, "Gasolux" refrigerator, and "Paravex" and "Nocturne" radiators. Many excellent slogans were displayed about the exhibit and on the appliances, attention being drawn in one slogan to the fact that the Company has unremittingly served Timaru for sixty years.

## Amalgamation and Grouping

*Swindon and District and Cirencester.*

We learn from Mr. Cecil H. Chester, Director, General Manager, and Secretary of the Swindon United Gas Company, that the recent offer of the Swindon and District Gas Corporation, Ltd., for the whole of the share capital of the Cirencester Gas Company, Ltd., has now been accepted.

*United Kingdom and Bedford.*

An offer has been made to the shareholders of the Bedford Gas Company by the United Kingdom Gas Corporation for their ordinary shareholdings on the basis of £133 in cash or 120 fully-paid ordinary shares of the Corporation for each £100 of consolidated ordinary stock of the Bedford Company, fractions to be paid in cash. The Bedford shares are to be acquired *cum* dividend and all other rights as from Aug. 23, 1937, and shares of the Corporation allotted in exchange will rank for the full final dividend in respect of the year ending Dec. 31, 1937, but not for any interim dividend which may be previously declared for that period.

## The Sir John Cass Technical Institute

### Courses for Gas Engineers and Technologists

We have received from the Principal of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C. 3, a copy of their Calendar for the Session 1937-38.

In the Department of Organic and Applied Chemistry there are five courses which concern the Gas Industry. The course in Gas Engineering (Manufacture), Part I., which is conducted by Messrs. A. H. Savill, M.Sc., A.I.C., and A. G. Higgins, M.Sc., A.I.C., starts on Sept. 24 and is held on Friday evenings from 7 to 9 p.m. The course is of an elementary nature and is intended for those who are employed in gas-works who wish to obtain a knowledge of the principles underlying the processes used in the Gas Industry. Part II. is held on Thursday evenings, commencing Sept. 23, from 7 to 9 p.m. The course in Gas-Works Practice—Experimental Work, given each Wednesday evening from 7 to 9.30 p.m. from Sept. 29, consists of laboratory work extending over the first two terms and is devised to supplement and illustrate the subject matter of the courses in Gas Engineering (Parts I. and II.). The above courses form part of the course of study for the examinations for the Ordinary and Higher Grade Certificates of The Institution of Gas Engineers.

Mr. Savill is also responsible for the courses in Coal Carbonization, which are of an advanced post-graduate nature and are suited to those who wish to offer the subject for the M.Sc. degree of the University of London. There are two parts—"Coal," a course of twenty-four lectures to be given on Mondays from 7 to 8 p.m., com-

mencing Sept. 27, and "Carbonization Processes and Products," a course of twenty-four lectures to be given during the next session.

A course in Fuel Analysis, Gas Analysis, and Calorimetry by Mr. W. D. Jones, M.Eng., Ph.D., will be arranged on evenings to suit the convenience of individual students.

Particular attention is also directed to the courses in Chemical Engineering, which are intended for those who have acquired an adequate knowledge of Chemistry or Engineering up to degree standard, and for those preparing for the examinations of the Institution of Chemical Engineers.

## Köbenhavns Belysningsvaesen

"The Mayor then pressed a button which set the coal elevator in action, thereby officially inaugurating the plant." Quite a commonplace climax to reports which from time to time reach the "JOURNAL" from the provinces. On this occasion, however, they have an outstanding significance, for the central figure on the dais was the Lord Mayor of Manchester, Alderman J. Toole; when he pressed the button a siren sounded; and it was the worthy citizens of Copenhagen who were thus informed that they were the proud possessors of an up-to-date carbonizing bench and auxiliary plant all manufactured and installed by leading firms in the British Gas Industry. The Lord Mayor of Manchester is paying an official visit to Copenhagen, and it was a fortunate coincidence that at the time of his arrival the stage was set for the official handing-over to the Lighting Committee of the new Westvertical plant—ten settings of four chambers each, with a capacity of 5½ million cu.ft. per diem. Alderman Toole has been greeted with enthusiasm and an excellent "press," and the inclusion of this function early in his visit meant that every spotlight was concentrated on gas and on what British trading firms can do for the Industry. Further, from many years' Chairmanship of the Manchester Gas Committee and personal friendship

The Lord Mayor of Manchester with Mr. Börresen, Director of the Lighting Department, at the Eastern Gas-Works of Copenhagen.

with Sir Frederick West, Alderman Toole was able to testify—and nobody could do so in more convincing manner—to the repute of West's Gas Improvement Company, Ltd., in England and throughout the world. It did not matter that he was preaching to the converted—as a matter of fact West's first contract for the Lighting Department was carried out 42 years ago, and in the intervening period they have been responsible from time to time for work at all the stations of the Undertaking.

The carbonizing bench, additions to condensers and exhausters, a Holmes benzole plant and Dri-gas plant, and a Kent station meter, have been installed at the Eastern Gasworks; and these were gay with British and Danish flags for the occasion last Saturday. The actual opening ceremony took place in the retort house, which was also bright with bunting and flowers, and fitted up with broadcasting and amplifying apparatus.

There was a large attendance which, in addition to the Lord Mayor's party, included the President of the Council, Burgomasters, Aldermen and Councillors of the Municipality, principal officials of the Lighting Department, representatives of the workmen, and several Engineers from other gas undertakings. Sir Frederick J. West, Mr. Frank West, and Mr. P. Roberts represented West's Gas Improvement Company; and the plant was officially accepted by Mr. J. E. Börresen, Director of the Lighting Department.

A full description of the plant and an account of the Undertaking's activities will be published next week.

St. George and the Dragon, 1937, played by Mr. Therm and Demon Foodwaste for the benefit of the Southend Hospital. This entry of the Gas Light and Coke Company was successful in winning third prize in the recent Carnival.

## Gas Undertakings' Results

### Glasgow.

The report by the Committee on Gas Supply to the Corporation of Glasgow for the year from June 1, 1936, till May 31, 1937, states the gross revenue amounts to £1,611,195 and the gross expenditure to £1,443,598, the balance carried to profit and loss account being a credit of £167,596. The Committee had to meet the following requirements during the year: Annuities on stocks, £16,090; interest on borrowed money, &c., £39,993; and sinking fund, £60,262—£116,344—leaving a surplus on the year's operations of £51,252. The surplus brought forward from year 1935-36 is £88,286, and the surplus carried forward to 1937-38 is £139,538. The quantity of gas delivered and accounted-for during the year amounted to 9,291,270,879 cu.ft., as compared with 9,144,177,473 cu.ft. for the preceding year, an increase of 147,093,406 cu.ft., equal to 1·609%. The unaccounted-for gas during the year was 7·76%, as compared with 7·27% for the preceding year. The quantity of coal carbonized during the past year was 649,573 tons as compared with 600,303 tons for the preceding year, an increase of 49,270 tons. The average cost was 18s. 9·036d. or 1s. 10·252d. more than the preceding year. The net sum realized from the sale of coke and breeze this year amounts to £245,181, being £80,101 more than that of the preceding year. The total quantity of coke and breeze sold during the year was 267,538 tons, compared with 272,815 tons for the previous year, a decrease of 5,277 tons.

### Middleton.

For the year ended March 31, 1937, the Engineer and Manager of the Middleton Gas Department, Mr. H. D. Robinson, states that the accounts show a gross profit of £10,568, as compared with £11,314 for the previous year, a decrease of £746. After meeting loan charges and income-tax and crediting certain amounts in respect of hire-purchase interest, properties account surplus, &c., there remains a net profit on the year's working of £1,628, against a corresponding figure of £1,712 for the preceding year, a reduction of £84. The balance of the net revenue appropriation account at the commencement of the year was £5,906, to which must be added the net profit for the year of £1,628, giving a total credit on this account of £7,534. Out of this sum it has been necessary, in the first place, to defray special expenditure amounting to £1,769. The total quantity of gas manufactured during the year was 225,010,000 cu.ft., compared with 229,796,000 cu.ft. last year, a decrease of 4,786,000 cu.ft., or 2·08%. The gas unaccounted-for was 11,845,000 cu.ft., as against 11,795,500 cu.ft. last year, the percentage being 5·26, against 5·13 last year, an increase of 0·13%. The net receipts for residuals and by-products amount to £7,140, equal to a return of 12s. 10·09d. per ton of coal carbonized, as against £6,303, or 10s. 11·53d. per ton, an increase of £837, or 1s. 10·37d. per ton.

### Wigton.

The annual report of the Wigton Gas Light and Coke Company shows that the revenue for the year ended June 30 was £5,468 and the expenditure £5,038, leaving a net profit of £430 for the year, which, with £394 brought forward, makes a total sum of £824 available for division. The Directors recommended that £250 be written off from the asset, "Land, buildings, &c.," and that a dividend of 6s. per share, free of income-tax, be declared, which would absorb £225 and leave a balance of £350 to be carried forward.

(*Further Gas Undertakings' Results see p.* 615.)

# the A P L E GAS PUBLIC LIGHTING INSTALLATIONS AT FOLKESTONE

Folkestone has undoubtedly been one of the brightest spots in the British Isles during the past few weeks. One hears of London's lights and Blackpool's illuminations, but it is probably unique in the history of artificial lighting for the greater portion of an important town to be turned over to a practical demonstration of all that is latest and best in street lighting and floodlighting. This is what has happened, however, at Folkestone in connection with the Annual Conference of the Association of Public Lighting Engineers.

For the annual gathering of an Association such as this, whose objects include the betterment of the lighting of our streets and the consequent greater safety of the travelling public by night, Folkestone is a particularly appropriate venue, for the normal lighting of its streets is divided fairly equally between gas and electricity. It was thus more practicable, through the co-operation of all concerned, to arrange representative demonstrations of each. The A.P.L.E., moreover, is a body which aims to steer a fair course between the rival interests which must essentially comprise its membership and in this way more effectively serve the cause to which it is dedicated. To this end the Association wisely chooses for its Presidents men from the gas and the electrical sides each alternate year, while its technical deliberations include Papers from both industries as well as those on the more fundamental aspects of lighting *per se*.

This year has been the turn for a " gas " President, and no worthier representative of an Industry which has done more than any other to sponsor the cause of street lighting during the past century could have been chosen than Mr. C. I. Winstone, Public Lighting Superintendent to the Gas Light and Coke Company. Mr. Winstone is directly responsible for the lighting of some of the most important streets in the Metropolis—thoroughfares which have been acknowledged the world over to be fine examples of public lighting. He was responsible as well for the magnificent displays of gas illuminations and floodlighting which were so wonderful a feature of the capital of the Empire during the recent Jubilee and Coronation celebrations.

It is largely to Mr. Winstone that the credit must go for conceiving the possibilities of Folkestone for a gas display on a scale which has probably never before been attempted —and for putting his ideas into practice. He saw in the Folkestone Conference an opportunity for showing the whole country, through the delegates who would attend the meeting, that gas, so far from being a back number in the public lighting field, was going ahead in a way that must seem remarkable even to those who are conversant with current developments. But Mr. Winstone could hardly have hoped to carry his ideas into practice unaided, even allowing for the fact that his own Company is connected with the Folkestone Undertaking through the South-Eastern Gas Corporation. Which brings us to a story of co-operation which has made Folkestone a veritable " showroom " of public lighting, as will be readily appreciated from a glance at the excellent photographs on this and the accompanying pages, which are reproduced by courtesy of Messrs. Hobbs Offen & Co., Ltd., of 68, Victoria Street, S.W. 1.

## The Plan of Campaign.

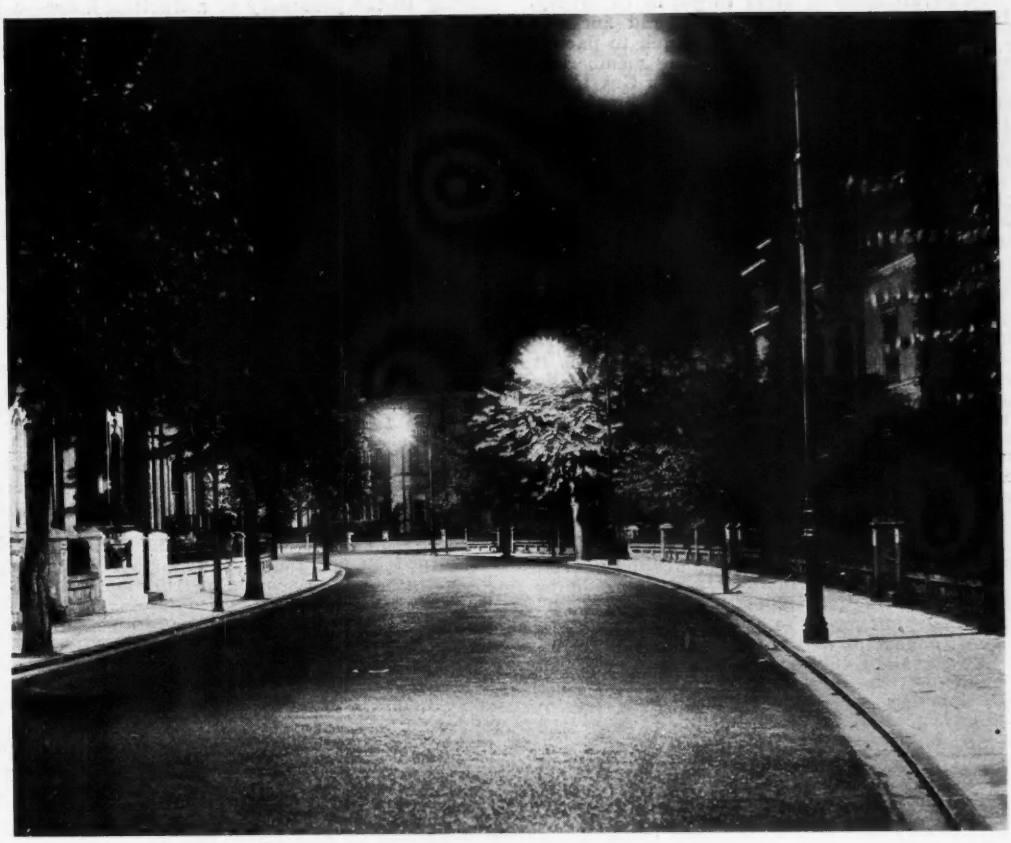
Once the general principles of the plan of campaign had been mapped out in consultation with Mr. G. le B. Diamond (Engineer and General Manager of the Folkestone Gas and Coke Company), Mr. P. G. Hobbs (Electrical Engineer), and the Borough Surveyor, and the

**Sugg's " London " Lamps in Earls Avenue.**

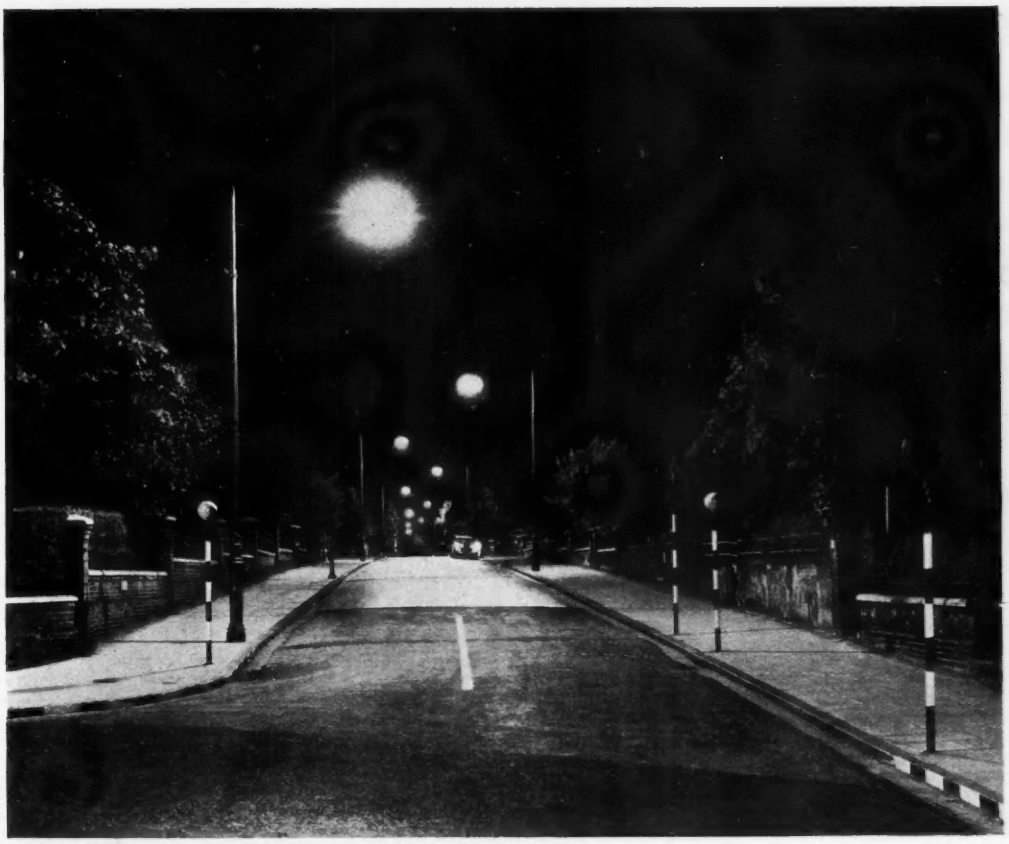
| Road. | Number of Units. | Spacing. Ft. | Class. | Makers. | Equipment. |
|---|---|---|---|---|---|
| Clifton Crescent and part of Trinity Crescent . | 10 | 134 | "D" | Foster & Pullen, Ltd. | "Avil" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Walter Slingsby & Co., Ltd. | "Wask" raising and lowering gear |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Holophane, Ltd. | Glass dish refractors |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Trinity Road . . . . | 5 | 130 | "G" | Foster & Pullen, Ltd. | "Avil" lamps |
| | | | | Metropolitan Pipe and Pole Co., Ltd. | Concrete columns |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Clifton Gardens and Trinity Gardens . . | 8 | 130 | "D" | Parkinson & Co. | "Maxill" lamps (new type) |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Walter Slingsby & Co., Ltd. | "Wask" raising and lowering gear |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Jointon Road . . . . | 6 | 125 | "G" | Parkinson & Co. | "Maxilla" lamps |
| | | | | Revo Foundry Co. | 12 ft. columns |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Metropole Crescent . . | 10 | 110 | "D" | Holophane, Ltd. | Glass refractor plates (in 16 in. square lantern) |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Manor Road . . . . | 10 | 135 | "D" | C. H. Kempton & Co., Ltd. | "Majestic" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | Horstmann Gear Co., Ltd. | Automatic clock controllers |
| | | | | " " " | "Comet" catalytic igniters |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles |
| | | | | Chance Bros. & Co., Ltd. | Globes |
| Shakespeare Terrace . | 3 | 140 | "G" | Revo Foundry Co. | 12 ft. columns |
| | | | | C. H. Kempton & Co., Ltd. | "Starlyte" lamps |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles |
| Cheriton Gardens . . | 10 | 77 | Between "C" and "D" | William Sugg & Co., Ltd. | "Folkestone" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Horstmann Gear Co., Ltd. | Automatic clock controllers |
| | | | | " " " | "Comet" catalytic igniters |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles |
| Earls Avenue. . . . | 19 | 135 | "D" | William Sugg & Co., Ltd. | 11 "London" and 8 "Folkestone" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | Horstmann Gear Co., Ltd. | Automatic clock controllers |
| | | | | " " " | "Comet" catalytic igniters |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| The Leas in front of Grand Hotel and Metropole Hotel . . | 8 | .. | "D" | William Sugg & Co., Ltd. | "London" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | Horstmann Gear Co., Ltd. | Automatic clock controllers |
| | | | | " " " | "Comet" catalytic igniters |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| Radnor Park Road . . | 17 | 137 | "D" | William Sugg & Co., Ltd. | 11 "London" lamps |
| | | | | Keith Blackman, Ltd. | 6 "Magnalux" L.P. lamps |
| | | | | " " " | Raising and lowering gear |
| | | | | Walter Slingsby & Co., Ltd.. | "Wask" raising and lowering gear |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Horstmann Gear Co., Ltd. | "Comet" catalytic igniters |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles for "London" lamps |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles for "Magnalux" lamps |
| | | | | Chance Bros. & Co., Ltd. | Globes |
| Cheriton Road . . . | 15 | .. | "D" | Keith Blackman, Ltd. | High pressure "Supervia" lamps |
| | | | | Newport and South Wales Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | " " " | Gas controls and valves |
| | | | | " " " | Compressors |
| | | | | Gas Efficiencies, Ltd. | High pressure mantles |
| | | | | Chance Bros. & Co., Ltd. | Globes |
| Outside Pavilion Hotel . | 4 | 137 | .. | Keith Blackman, Ltd. | "Supervia" high pressure lamps |
| | | | | Bromford Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | " " " | Gas controls and valves |
| | | | | " " " | Compressor |
| | | | | Gas Efficiencies, Ltd. | High pressure mantles |
| | | | | Chance Bros. & Co., Ltd. | Globes |
| Marine Terrace and Lower Sandgate Road | 6 | 104 | .. | Keith Blackman, Ltd. | "Magnalux" low pressure lamps |
| | | | | Bromford Tube Co., Ltd. | Steel columns |
| | | | | Keith Blackman, Ltd. | Raising and lowering gear |
| | | | | Lighting Trades, Ltd., and the Welsbach Light Co., Ltd. | Mantles |
| | | | | Chance Bros. & Co., Ltd. | Globes |
| Victoria Grove and Cheriton Place . . . . | 7 | 80 | .. | Wm. Edgar & Son, Ltd. | "Rivercourt" lamps |
| | | | | Revo Foundry Co. | 12 ft. columns |
| | | | | Gas Meter Co., Ltd. | Automatic clock controllers |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles |
| | | | | Holophane, Ltd. | Glass dish refractors |
| Ingles Road and Mill Field . . . . . | 9 | 115 | Between "G" and "F" | William Sugg & Co., Ltd. | No. 8,000 lamps |
| | | | | Revo Foundry Co. | 12 ft. columns |
| | | | | Horstmann Gear Co., Ltd. | Automatic clock controllers |
| | | | | Falk, Stadelmann, & Co., Ltd. | Mantles |
| Castle Hill Avenue, junction Shorncliffe Road. | 7 | .. | .. | Gowshall, Ltd. | Illuminated "Guardian Angel—Minor guardposts |
| | | | | Horstmann Gear Co., Ltd. | Clock controllers |
| Pavilion Hotel . . . | .. | .. | .. | William Sugg & Co., Ltd. | 30 10-lt. No. 2 Parabolic floodlamps |
| | | | | Keith Blackman, Ltd. | 4 High pressure spot lights |

**Parkinson's "Maxill" Lamps in Clifton Gardens.**

**Sugg's "Folkestone" (High-Visibility) Lamps in Cheriton Gardens.**



**Foster & Pullen's "Avil" Lamps in Clifton Crescent.**



**Kempton's "Majestic" Lamps in Manor Road.**

demonstration streets allotted either to gas or electricity, the manufacturers of gas lighting fittings and ancillary equipment were approached with an invitation to participate in this unique demonstration. Leading members of the Lighting Section of the Society of British Gas Industries readily agreed to associate themselves in the scheme, and it is in no small measure due to their wholehearted co-operation that so fine a display of many of the very latest types of gas lamp has been possible. Several of the lamp manufacturers, indeed, have installed absolutely new fittings, specially produced for the occasion, and we have no hesitation in saying that these will surprise the Gas Industry as well as the layman, so astonishingly good are the results obtained from them. Great credit is therefore also due to these manufacturers, who have in the majority of cases not merely despatched their units to Folkestone, but have sent their own staff and equipment to assist in the erection and adjustment of the fittings.

Such co-operation is all the more praiseworthy when it is appreciated that a number of firms who would normally be competing for the Industry's business have come together in a united effort to further the cause of gas for street lighting generally. It is to the healthy rivalry between such firms, indeed, that much of the technical improvements in lighting equipment in recent times is largely due.

## The "Men-on-the-Spot."

No amount of co-operation would be of avail, however, were it not for the "men-on-the-spot." Much could be written of the unsparing efforts of Mr. Diamond, Mr. Macdonald, his assistant, and the staff of the Folkestone Gas and Coke Company, as well as of Mr. Winstone's own colleagues. Most of the actual installation work has fallen upon the shoulders of the Folkestone Company, who have laid no fewer than 150 special services to feed the demonstration lamps, in addition to much piping to serve the needs of the floodlighting units.

They installed a special Keith-Blackman compressor of an output of 2,000 cu.ft. per hour at the Royal Pavilion Hotel to supply the four high-pressure lamps in the roadway outside and the battery of 34 flood-lamps which throw that Hotel into brilliant prominence, with its gilded dome, picked out by spot lamps, glittering above the waters of the harbour. The other section of high-pressure lighting is in the Cheriton Road, where mention should be made of the particularly interesting compressing plant, the layout and details of which are largely due to Mr. Macdonald. Owing to the proximity of a dwelling-house—a matter of a few feet only—it was essential that the gas engine should be as nearly silent as possible. A special silencing system was therefore incorporated, with the result that, standing quite close to the compressor building the only sound is that faintly audible from the valves of the engine itself. This compressor plant is entirely automatic, being clock controlled to come into operation and shut off again at predetermined times. In the event of mechanical failure of the gas engine the pressure drop causes an emergency electrical drive to come into operation, which is itself clock controlled to switch off again at the appropriate time.

There is no need to refer in these notes to the various individual lighting installations, full details of which are appended in the accompanying list. They are, however, uniformly excellent, and the view of six different systems, gas and electric, from Clark's Corner, at the foot of Cheriton Gardens, provides not only a remarkable spectacle but also an interesting comparison between modern methods—and a comparison of which the gas systems have no cause to be afraid. Attention may be drawn to the fact that catalytic igniters have been adopted, showing that gas lighting systems are no longer dependent upon the by-pass, always a tricky feature, and especially so in seaside towns where high winds sometimes prevail. Automatic control of the lighting is another feature of the gas installations, whereby whole roads or individual lamps can be turned on and off at fixed times without recourse to human aid. The scientific distribution of all the light to the points at which it is most required by means of specially designed reflectors gives some indication of the technical development which has been taking place in recent times, while the generally pleasing design and neat appearance of many of the newer fittings and standards is particularly noteworthy. Altogether it may be truly said that gas has achieved a triumph in the streets of Folkestone which will redound to the credit of the Industry as a whole—and this, it should be mentioned, in thoroughfares whose tree-lined verges by no means simplify the task of the lighting engineer.

## Floodlighting.

The part that gas can play in floodlighting is already well recognized, and this side of the picture is by no means overlooked at Folkestone. Reference has already been made to the floodlighting of the Royal Pavilion Hotel,

Keith-Blackman's "Supervia" Lamps in Cheriton Road.

which is illuminated by 30 flood-lamps and four spot lights which play on the gilded dome. In addition to this, a remarkable piece of lighting has been carried out on the Leas, where the Coronation Bed—a beautifully laid-out flower bed, consisting of no fewer than 80,000 bulbs so arranged as to make an appropriate Coronation display, with a Union Jack and other Royal symbols picked out in coloured flowers—has been illuminated with six 10-mantle Sugg's parabolic projectors. So excellent is the effect of gas for this purpose that very little of the colour is lost under the artificial light.

Residents of Folkestone will have been familiar with the floodlighting of the Kingsnorth Gardens since the Jubilee Celebrations. Additional flood-lamps have been installed for the present occasion, and more than sixty units now serve to illuminate these beautiful gardens after dark, including coloured effects which light up the fountains. Special "Fireglow" mantles are utilized where red colours predominate, and the whole effect is most striking, and a wonderful testimony to gas. The entire system is operated from a single relay control at the point where the 3-in. service enters the gardens.

We feel that, as a result of this Conference of the Association of Public Lighting Engineers, attention will be focussed to a greater extent than ever before upon the paramount importance of good street lighting, and, thanks to the splendid co-operation of all those whom we have mentioned in connection with the demonstrations, there is no doubt that particular interest will be attached to the Gas Industry's contribution. We took the opportunity of driving through all the demonstration streets in the "square mile" which has been allotted to the displays, and there is no need to add our testimony to that of the accompanying photographs to emphasize that gas has nothing to fear on the standards of its showing at Folkestone. No more than side-lights were necessary in any of the demonstration streets—and only these because the law demands them. The roads are remarkable for their visibility and even light distribution, and each thoroughfare has been scientifically illuminated according to the actual needs of the roadway and not merely to produce a brilliant effect.

It remains now for the Gas Industry to take advantage of this initial success at Folkestone—and, given a fair field and no favour, there is little to prevent the valuable public lighting load being multiplied many times over.

**The "Coronation" Flower Bed on the Leas floodlighted by Sugg's Lamps.**

## Lubrication at High Temperature

### Use of Colloidal Graphite

The subject of lubrication has undergone a change during the past ten years. It has grown from a secondary issue in engineering to a science of its own, and the lubrication expert is to-day an important addition to a world already honeycombed with specialized departments. In gas engineering, as in many other branches of industry, the problem of temperature in lubrication assumes some importance. One might say that the whole subject of reducing friction is bound up with temperature, but these notes are concerned with the external temperature factor—that is to say, heat which is radiated or passed by conduction to a bearing.

Graphite is a most efficient high temperature lubricant. Its use, however, has been severely limited by lack of purity and fineness. The introduction of graphite made from selected raw materials and colloidalized by the Acheson process has enabled graphite lubrication to be adopted in practically every industry. Colloidal graphite is the material reduced to a state of fineness that when dispersed in oil or water it will pass through the finest channels and through filters of the felt type. It must be distinguished from ordinary finely powdered graphite; whereas the latter could not be used in high speed automobile engines, the colloidal variety is used by automobile engine manufacturers throughout the industry. It has been shown at the National Physical Laboratory to be suitable for ball bearing assemblies, and as a dispersion in oil is used in the assembly and running of the largest stationary diesel engines down to the lubrication of automatic telephone exchange equipment in this country.

As a dispersion in water, colloidal graphite has now become standardized by certain manufacturers as a cylinder lubricant. G. & J. Weir, Ltd., fit a special lubricator to their productions which feeds in "Aquadag" colloidal graphite in water into the inlet steam line. Sissons, Ltd., have found it a valuable lubricant for high speed steam engines, and also fit a lubricator for the purpose. Briefly, the minute particles of graphite are swept in with the steam, and being plate-like form a lubricating surface on the cylinder walls, valves, and other friction faces, such as valve guides. Being a high temperature lubricant and resistant to high bearing pressures it reduces wear and eliminates groaning where the latter is due to inadequate lubrication. There appears to be a general growth in the use of colloidal graphite for steam plant lubrication, one important advantage being that the condensate, being uncontaminated with oil, can be returned to the boilers without trouble due to foaming, or used for process work.

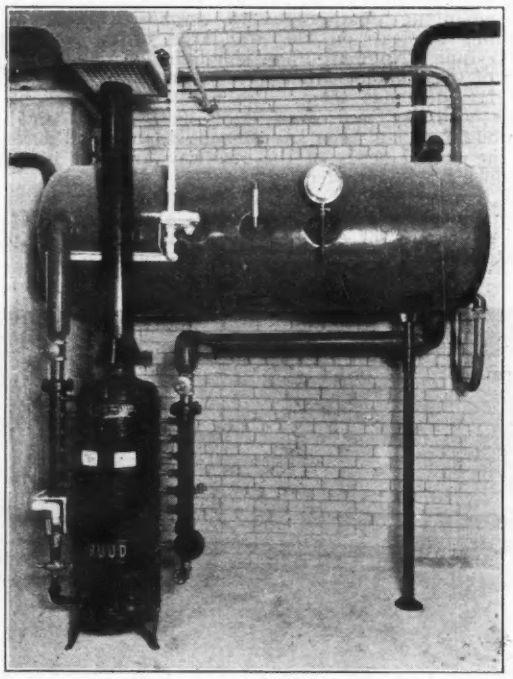
The addition of colloidal graphite to a gear oil raises the maximum temperature at which the oil will lubricate efficiently by about 35° F. and reduces friction by 15%, according to a test carried out at the National Physical Laboratory.

The assembly and running-in of gas and oil engines either when new or after a major overhaul can have an important influence on their life. During running-in the working faces bed in accurately, but at the same time, if properly lubricated they will acquire wear-resisting surfaces. In the course of research work on lubrication with colloidal graphite it has been shown that bearing faces, being protected from undue abrasive wear, acquire a finish with superior bearing qualities.

Colloidal graphite in oil is now used extensively for the lubrication of conveyor chains in ovens and for the bearings in kiln cars in annealing furnaces. It is also employed for a variety of small mechanisms and is of particular value where a thin oil would dry off the bearing.

The above notes indicate the potentialities of this unusual adjunct lubricant, and it will be interesting to see how its characteristics lend themselves to the solution of some of the gas engineer's problems.

# Gas Water Heating at the New Earl's Court Exhibition Building




Twelve Sinks are supplied by this 200-gall. per hour Heater, coupled to a 250-gall. Storage Cylinder.

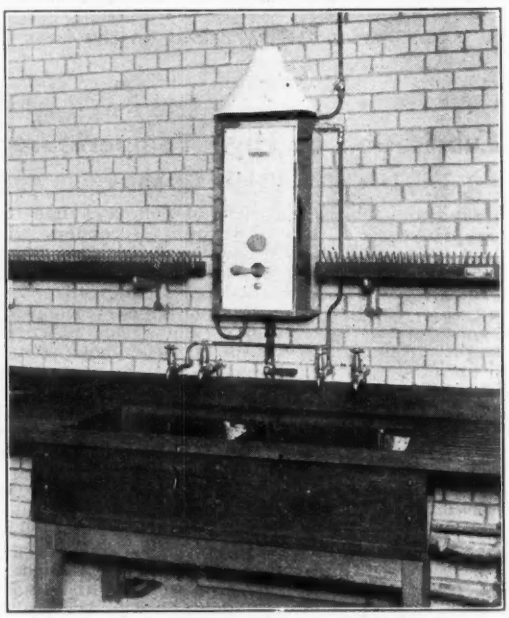
**In the course of our review in the "JOURNAL" for July 14 last of the extensive gas installations in the kitchens of the new Earl's Court Exhibition Building, we mentioned that "Ruud" gas heaters were responsible for hot water supply. Further particulars of the part gas plays in the provision of adequate supplies of hot water for the very considerable requirements of these huge kitchens have been furnished by the National Gas Water Heater Company, Ltd., of Wembley, who have been responsible for the installation of fourteen water heating appliances of one kind or another for various purposes.**

To recall to our readers' minds the magnitude of this catering job, it may be repeated that the kitchens serve four restaurants (with a seating capacity of 4,000), five tea lounges, and twenty-five snack and lounge bars. There are also three conference halls which can be converted into banqueting halls for special occasions. Naturally a kitchen planning job of this immensity called for special consideration, and many problems had to be surmounted.

The water heating appliances provide an interesting example of the wide range of such apparatus, for they vary in size from a heater capable of producing 350 gallons of water at a temperature of 140° or 150° F. per hour to a small, but equally efficient, sink heater. The reason for this diversity in size is a simple one. With kitchens and service rooms placed conveniently about the huge exhibition building it would have been an immense problem to run hot water piping from a centrally placed battery of heaters. The same result—instant hot water at each necessary spot—has been more simply and inexpensively achieved by the installation of the right size of water heater at each point.

In one of the two main basement kitchens, for instance, there is a National "Ruud" multi-coil heater with a capacity of 350 gallons per hour; this is coupled up to a storage cylinder holding 600 gallons and has therefore a peak capacity of nearly 1,000 gallons. The restaurant served by this kitchen seats 1,000 people and is ready to serve three times this number at a single lunch time. In the second basement kitchen a similar heater, but of 200 gallons per hour capacity and with a storage cylinder of 350 gallons, is installed. The service kitchen on the mezzanine floor caters for a restaurant with seating accommodation for 500; here a 200 gallon per hour heater and a 250 gallon storage cylinder supply the twelve sinks with hot water. The main banqueting hall service kitchen has six sinks; an instantaneous (continuous flow) water heater delivering 8 gallons of hot water per minute is installed here, and in the kitchen serving the tea lounge on the same floor two smaller instantaneous heaters, each with an output of 4 gallons per minute, are fitted. In the Exhibitors' Staff cafeteria and two other cafés the need for hot water is confined to a single sink; a small instantaneous sink heater is sufficient to cope with the demand for hot water.

It will be seen from these examples that each kitchen, wherever situated and of whatever size, has been given an independent hot water supply by the installation of the right type and size of gas water heater—a proof, if proof were needed, that gas can tackle the largest job as easily as it can satisfy the needs of the smallest kitchen.



This Heater and a similar appliance serve four Sinks (two each) in the Tea Lounge Kitchen.

The work that gas will be carrying out at Earl's Court will be behind the scenes, but it is none the less important for that, and it is gratifying to the Industry as a whole to know that for the essential jobs of cooking and water heating in this modern building gas has won on its merits.

# THE ASSOCIATION OF PUBLIC LIGHTING ENGINEERS

## PRESIDENTIAL ADDRESS

of

**C. I. WINSTONE,**

Public Lighting Superintendent of the Gas Light and Coke Company.

THE PRESIDENT.

## ANNUAL CONFERENCE

at

**FOLKESTONE**

Sept. 6-9, 1937

I fully realize the honour you have extended in electing me as your President for the forthcoming year; I deeply appreciate it and thank everyone of you. At the same time I also realize the great responsibility which attaches to the position of President of the Association of Public Lighting Engineers, because for twelve months the guidance of the Association comes under his care. You can rest assured, however, that the best of my ability and experience will be freely given in the interests of the Association.

The past Presidents have done some fine work for the Association. They have set a high standard for me, and for the future Presidents who will come after me, and it will be my utmost endeavour during my year of office to maintain the dignity of this position, and to further the interests of public lighting in this country.

Thirty-eight years ago I was transferred from the Mains Department, where I had been working as a draughtsman, to the Public Lighting Section of the Company I have the honour to serve, and during all these years I have been engaged entirely on work connected with public lighting. Some of you have similarly spent your lives in this work, and when we recall those early days of public lighting and compare them with what is being achieved to-day we are amazed, but we look into the future and believe that there are yet still greater achievements in store for the advancement of public street lighting.

When gas was first introduced, the first thing it was made to do was to give light; similarly when electricity was first generated it was to the production of light that first consideration was given.

The production of light started these two great industries of gas and electricity which now contribute in manifold ways to the health and comfort of the people everywhere. We Lighting Engineers can therefore claim to be members of a very old and time-honoured profession.

Let us consider for a moment the vast achievements that have been made in the production of light.

Thirty-eight years ago one cubic foot of gas burned as a flat flame produced 25 lumens, and with electricity in a carbon filament lamp one watt produced about 3·5 lumens.

Compare the position to-day—one cubic foot of gas will produce in the latest type of low-pressure lamp 300 lumens, and in the latest high-pressure lamp 364 lumens, an increase of 1,450% for gas in a high-pressure lamp. One watt of electricity will produce in the tungsten filament lamp 16·8 lumens, and in the electric discharge lamp 55 lumens, an increase of 1,570% as regards the discharge lamp.

Truly magnificent achievements! But this does not end the story. There is no finality to progress. Just as I stand here to-day and state these facts, so will future Presidents be able to record from year to year further achievements in the efficient production of light, perhaps even more remarkable than those I have mentioned.

It is a physical fact that nothing stands still, and when we realize the scientific methods of investigation adopted nowadays to achieve improvements in the production of light, past experience has taught us to expect further progress in this direction in the future.

Six years ago Mr. J. Swinburne, Fellow of the Royal Society, ended a lecture he gave to the Illuminating Engineering Society with these words: "What the next great step will be I do not know. Most likely it will be in the direction of utilizing some form of electron discharge." That is now achieved.

Mr. W. J. A. Butterfield also ended a lecture on Gas Lighting at the same meeting with these words: "It is not improbable that one of the next stages in the history of gas lighting will depend on the development of gas burners which are self-lighting without a by-pass." Such burners are in use to-day, especially for public lighting. Who then would dare to say finality in achievement is reached?

Progress in the distribution of light will, no doubt, keep pace with progress in the efficient production of light from the source of energy, but it seems to me that some of the methods now in use for the distribution of light in connection with public lighting are more spectacular than useful.

For instance, travelling on certain main roads at night it is possible to see a very bright halo over a town, and on arriving there you notice that the public lighting installation is composed of lamps where a percentage of the light goes above the horizontal. To my mind this is a wasteful way of illuminating a street. In my opinion all lamps should have a cut off to prevent the light from being distributed above the horizontal. By preventing this more light could be reflected on to the road surface, and the cost per mile for the same degree of illumination would be materially reduced.

### Lighting Costs per Mile.

The cost per mile is a very vital matter. Every Council has to study expenditure, and in all branches of commerce endeavours are made to reduce waste. Why, then, should we not study more this aspect of the question and provide fittings which will reflect all the light from the source downwards on to the street?

At present there appear to be two schools of thought on this subject. One which advocates the complete cut off, and the other which advocates the seeing of a bright source. There is a happy medium which will prevent the waste of light which occurs in some installations, and also the dull uninteresting appearance common to other installations where the source of light is obscured until one gets almost underneath the lamp.

Sufficient illumination on a road, we are told, will reduce accidents. But what is sufficient illumination? There are eight classes in the British Standards Institution Specification for Street Lighting, and we all agree that Classes "D," "E," and "F" are the classes suitable for main road lighting, but even in roads lighted to "D" classification there are accidents. I know a case where a lorry driver killed a cyclist, and he alleged in evidence that the cause of the accident was poor lighting. This road was lighted to a "D" classification; it was tested and found to be correct, and the visibility was good. It was the early part of the night when the accident occurred, therefore the driver was not likely to be sleepy. Accidents of this nature tend to make people think that roads should be lighted to "C" classification or more. But to people with normal eyesight a road lighted to "D" classification gives ample illumination for night driving without headlights.

There are people driving vehicles to-day who have eyes which cannot see properly in such degrees of illumination as are provided under Classes "C," "D," "E," and "F," although they can see perfectly well in normal daylight. Every driver of a vehicle should be compelled to pass what one may describe as a "night seeing test."

I once had a driver who, although good during the day

time, was a danger at night time owing to the disability I have just mentioned, and in consequence he had to be taken off my night work.

I am afraid there have been many night accidents where the driver's eyesight and not the lighting was the cause of the accident. The number of cars is increasing on the road at the rate of 500 per day. The death and accident rates are not decreasing. Further improvements in the lighting of the roads are very necessary for people who can see, and regulations are necessary for preventing people from driving on the road at night who cannot see in low degrees of illumination.

The eye is a wonderful thing, and its accommodation to low degrees of illumination is extraordinary, as you all know. The illumination on the ground on a sunny day in June is 10,000 foot candles, and on the average lighted main road the illumination may be only 0·2 foot candle on the test points, with an average illumination of 0·5 foot candle, and yet I can see 300 yd. ahead through the glass windscreen of a car with a degree of certainty that would prevent me from running a person down. I believe my eyesight in this respect to be normal, and I must admit that to me a road lighted to a generous "F" classification with 0·07 foot candle on the test point and good visibility always seems a well-lighted road.

I have checked up people driving at 60 miles an hour on an arterial road lighted in this manner, and although I know of roads where this speed is permitted with this classification I cannot say I agree with it.

What, then, do we consider is a safe illumination for varying speeds? I have carried out many investigations in connection with this matter, and experience has taught me that without headlights:

> A generous "F" classification of 0·07 foot candle is perfectly safe up to 40 miles per hour;
>
> An "E" classification of 0·1 foot candle is safe up to 50 miles per hour;
>
> A "D" classification of 0·2 foot candle is safe up to 60 miles per hour;

provided, of course, that in all cases there is good visibility. With these equivalent degrees of lighting and speeds one can pull up easily within the distance one can see.

This may seem to you rather extraordinary, but I ask you to try the experiment, and if the pupils of your eyes are the same as my driver's and mine you will find that what I have said is correct.

Taking an average speed of 45 miles an hour it will be seen that I have suggested Classification "E" with good visibility as being sufficient according to practical tests of night driving. Now there are many miles of main roads in this country lighted to "D" classification, and many more miles lighted to below "F," and even lighted so badly that a photometer would not work on the test points.

If there were one central authority in this country which governed the expenditure for lighting main roads, bearing in mind that lighting costs money, and should therefore be planned economically, would it not be possible to light satisfactorily many miles of main roads which are at present either badly lighted or not lighted at all, by cutting down to a sufficient illumination roads which are at present extravagantly lighted? The money saved could be more evenly distributed and used to light some of the appallingly lighted main roads one sees about the country. It is in many cases absolutely impossible for a poor parish to find the money to light a national main road where very often 90% of the traffic is foreign to the district.

We know that many Councils have important main roads passing through their areas, and have not the money to light them properly. Richer Councils use their money to light their roads in some cases to a degree which is unnecessary. I am not, of course, referring now to the shopping districts or centres of cities, but to traffic routes into and from a centre. If, therefore, the whole of the expenditure on public lighting could be pooled, and we could reach a conclusion based on the lines I have suggested, it would be possible to carry out a great improvement in the illumination of poorly lighted main roads, and the great danger caused by running from a well-lighted main road into a state of almost complete darkness would be obviated.

I know certain roads bathed in a brilliant light from dusk until dawn which do not carry 20 vehicles an hour after 1 a.m. Money would be saved by reducing the lighting after 1 a.m. Parishes with badly-lighted important main roads running through them, carrying far heavier traffic than I have just mentioned, would welcome this saving to enable them to light their own roads sufficiently to ensure a fair degree of safety. Only a Central Authority governing the whole of the country could bring this about.

The former Minister of Transport, Mr. Hore-Belisha, introduced some valuable legislation for improving the safety of main roads, but unfortunately he was unable to help towards the lighting of the roads.

May we ask our new Minister of Transport, Mr. Burgin, to keep this matter before Parliament and see what can be done towards an improvement on the lines I have ventured to suggest?

## Road Brightness.

I want to speak for a few moments on the vexed question of road brightness *versus* test point illumination.

This subject has caused more controversy than any other in connection with public lighting. One school advocates road brightness without the trace of a shadow on the road, the other advocates test point illumination with the possibility of shadows occurring.

Let us examine these two opinions in a practical way. Many Lighting Engineers are mystified by the highly scientific arguments put forward by both schools of thought. Firstly, I want to say that I have written this section of my Address many times to try to set the matter down with perfect clarity, and even now I am afraid that some of my deductions may seem wrong to exponents of the theory of road brightness.

The British Standards Institution Specification specifies that the minimum illumination must be on the test point which, as you know, is that point equidistant between two lamps. We also know that it is possible so to focus the light from the lamp that it will give the illumination asked for in a tender, based on these principles, to the detriment of the general brightness of the road surface, because the illumination may appear patchy and yet cover the stipulations laid down in the tender.

To illustrate my meaning I will quote an example, because by so doing the case is more readily understood.

The lamps in an installation are spaced 150 ft. apart, they are mounted 25 ft. high, the test points therefore are approximately 80 ft. from the lamps. The installation is to be a "D" installation, that is, 0·2 foot candle on the test points. Under the specification Lighting Engineers have endeavoured so to direct the beam of light giving a high candle power (which would have to be approximately 18° below the horizontal to cover this area) as to prove to the purchaser that the installation comes under the classification asked for in the tender. But, by so doing, have they succeeded in well illuminating the roadway to give even illumination, good visibility, or good road brightness? I don't think so.

How, then, is good visibility and road brightness to be obtained? Certainly not by focussing the light on to the test points, but on to the area in the roadway near the next lamp which would mean having the beam approximately 10° instead of 18° below the horizontal for a spacing of 150 ft.

By doing this you may reduce the test point illumination under the B.S.I. Specification by about 50%, but what a difference to the roadway owing to better visibility and road brightness.

An installation giving 0·1 foot candle on the test points with the beam focussed on to the area round the next lamp will give far better results than the same installation with the beam on the test points reading 0·2 foot candle. The eye is the final judge of all installations. There is no scientific instrument made that will register and convey the feeling that the illumination is satisfactory like the human eye. You can put graphs, iso foot candle diagrams, and photographs in front of a Lighting Committee, but by what means do they ultimately come to a decision? By going out and looking at the illumination on the roadway. Let us then not give so much consideration to test point illumination, but rather give more consideration to good general illumination, and to improved visibility.

## Providing Good Visibility.

This is one of the ways it can be achieved, and in this respect the street lighting specification should be altered. These are the main basic facts that provide for well-lighted roads with good visibility, and which have been proved by practical experiments and tests in the streets.

I have not stated all the factors governing these points; it would take a Paper all to itself; but no doubt you will realize all this after thinking over the main principles involved.

I now want to refer to the 50% depreciation allowed in the B.S.I. Street Lighting Specification. Is it right or fair that such a big depreciation should be allowed? I know of installations, both gas and electric, where the illumination is between 40% and 50% less than the illumination quoted for in the tender to the Municipal Authority. We are tempted to say that it is not playing the game to allow this kind of thing. The 50% depreci-

tion tends to cause the maintenance of installations to be neglected.

In my opinion not more than 25%, or at the very most 30%, depreciation should be allowed; that is to say, the installation should be constantly maintained to ensure that the illumination never falls more than this.

Both gas and electricity can be maintained to this standard, and to sell an installation which on the first night is rated an "E" class installation, or possibly more, and then within a short period the illumination drops by 40% to 0·06 foot candle, and never again comes within 75% of the original illumination, is wrong, and this Association should endeavour to obtain a specification which provides for the percentage of depreciation to be fairer and more equitable to the purchaser. If the performance of your car falls 50% you get very worried about it and think about selling it. The machinery and plant in the electric generating station and the gas-works are certainly not allowed to depreciate 50%—it would be a very unfortunate thing for us as Lighting Engineers if it were so.

There are many other things in connection with present-day conditions where a depreciation of 50% would be considered a danger line, and I know of no instance other than Public Lighting, where the safety of life and limb is concerned, where it would be tolerated. The lighting of a street is a matter which concerns the prevention of injury to human beings, and I say that if it is decided to have a generous "F," "E," or a "D" installation, then it should be definitely maintained as such, within reasonable limits, and in my opinion 50% depreciation is not a reasonable limit.

## Cleaning Fittings.

I know a case where the quotation for the tender allowed for cleaning the lamps only three times a year, and I know of another case where the lamps were cleaned once every two months.

Would anyone here agree that it was not necessary to clean the windows of his house more often than once in two months? One of these cases was an electric tender and the other a gas tender. In neither case was the person responsible for the tender a member of this Association.

Manufacturers of gas and electric street lighting apparatus supply us with good equipment, the perfection of which has cost them large sums of money in experimental work. Let us then maintain our installations in such a way that it does credit to the men who made the lamps and fittings.

The charges quoted in a tender should not be cut down to such a minimum that the maintenance cannot be carried out properly.

Let me give you the result of a test to make my case clear. During the 17 weeks ended Nov. 18 last year I carried out the following test:

Eight pieces of 21 oz. flat clear glass 12 in. square were fitted in a frame 8 ft. long and fixed vertically 16 ft. above ground well away from buildings. At the end of every two weeks one piece of glass was removed and placed in an air-tight box. This was done until 7 pieces were taken down, and the eighth piece was left for a further three weeks. The eighth piece therefore was exposed for 17 weeks. They were then tested piece by piece for absorption caused by the dirt from the atmosphere, with the result shown in the table:

*Test for Absorption Through Dirty Lamp Glass Exposed in Westminster.*

| — | From July 22, 1936. | | % Absorption. |
|---|---|---|---|
| Glass No. 0 . . | Clean | — | 9·5 |
| ,, No. 1 . . | Exposed | 2 weeks to Aug. 5 | 11·0 |
| ,, No. 2 . . | ,, | 4 weeks to Aug. 19 | 11·2 |
| ,, No. 3 . . | ,, | 6 weeks to Sept. 2 | 12·2 |
| ,, No. 4 . . | ,, | 8 weeks to Sept. 16 | 12·6 |
| ,, No. 5 . . | ,, | 10 weeks to Sept. 30 | 13·4 |
| ,, No. 6 . . | ,, | 12 weeks to Oct. 14 | 16·6 |
| ,, No. 7 . . | ,, | 14 weeks to Oct. 28 | 17·5 |
| ,, No. 8 . . | ,, | 17 weeks to Nov. 18 | 18·2 |

A perfectly clean piece of glass was tested for a standard, and this absorbed 9·5% of the light. The first piece of glass that had been in the frame two weeks was then tested and the absorption rose to 11%. The depreciation shown by the next piece which had been in the frame four weeks had risen to 11·2%, and the next piece to 12·2%, and so the absorption increased until the last piece which had been in the frame for 17 weeks was absorbing 18·2% of the light. It means that 8·7% absorption was due to dirt alone. All the above glass was cut from one sheet.

Many interesting points present themselves with regard to this test which are being investigated. For instance, what is the percentage of absorption in different makes of clear glass and with different thicknesses?

Looking at the table you can tell the weeks where the weather was fine and where it was bad by the varying increase in the absorption percentage. For instance, you will notice in one case the absorption increased by only 0·2%; in another case the increase in two weeks was 3·2%.

The results of this test are on the light side because there was no heat to bake the dirt on as there would be in a lighting fitting, and there was no traffic to disturb the dust and dirt in the street, so that the actual percentage of absorption due to dirt would, no doubt, be more than I have stated.

I am giving these facts to try to stress the importance of maintaining lighting installations well because I have found that cleaning is the one thing which is neglected most.

An important part of our work is the maintenance of the installations after we have fixed them, and although in the early part of this Paper I have used the term "normal eyes," it must be admitted that the eye can judge the intensity of illumination only within very wide limits. As a scale is to the architect, so is a photometer to a Lighting Engineer. It is the last tool he uses for checking up his work, and yet how many officials responsible for the public lighting possess one? It is the most valuable piece of apparatus a Lighting Engineer can have.

Good photo-electric photometers are available to-day which can be used to verify that installations are maintaining the illumination they were provided to supply. They can be used with confidence, and will place the Lighting Engineer in full possession of the results he is obtaining and assist him to improve the installations if they are found wanting. I say to everyone who is responsible for public lighting: Get a good photometer and use it every week. It will often astonish you by the results it will reveal. Everything in life is governed by measurement, and illumination requires the same application to enable us to understand the quantity and quality of the product with which we are dealing. I know many installations which are giving a straight line illumination, and this result is only obtained by the constant use of a photometer.

The profession of Lighting Engineer is a fine one, for any man who has the necessary aptitude and enthusiasm. You not only have to work during the day, but you have to carry on work at night, because only at night time can you see the result of what you have planned in the day time. In this respect it is a man's job, and I say to the young men listening to-day: Make up your minds and take it as a life-time job, because I can affirm after 38 years of it that I still think it is one of the finest jobs a man can undertake. Other Engineers in this Conference Hall will bear me out when I say it is one of the most interesting jobs for a young man to take up.

The Association of Public Lighting Engineers has now made its influence felt among all who are connected with public street lighting in this country. The stronger the Association becomes in its membership the greater becomes its weight and influence on public opinion, and when you get agreement in public opinion your case is practically won. Therefore let us endeavour to increase our membership still more. There are over 1,000 municipal councils ranging from City Corporations to Urban District Councils in England and Wales who are interested in and have the power to vote money towards public lighting, and we should not be content until each one of those authorities has its representative on the membership roll of the Association.

I have tried to arrange a Conference that will be a practical one, and although it is not the year for the Association's official exhibition, I felt that if it were possible to have some installations of gas and electric street lighting of various types fixed in the streets under actual service conditions, members would gain further knowledge by inspecting them.

These installations will, I hope, help to make the Conference an interesting one, and we all owe a debt of gratitude to Mr. Allman, the Borough Engineer; Mr. Hobbs, the Electrical Engineer; Mr. Diamond, the Gas Engineer, and the electric and gas street lighting apparatus manufacturers, for their willing co-operation and for the trouble they have taken; and also my thanks are due to the Governor, Directors, and General Manager of the Gas Light and Coke Company for their kindness in granting me the facilities to do what I have been able to do in an endeavour to make this Conference so informative and interesting. Like many of you here I am a practical man, and as such we have to try and translate into actual practice the theories of the theorists. Sometimes it cannot be done, but the theorists are valuable members of the illuminating engineering profession, and I venture to suggest that all the wonderful advances that have been made during the past years have been due to the theorists working in co-operation with experienced practical men.

THE A.P.L.E CONFERENCE

# High Intensity Gas Lamps

by
G. KEITH

A Paper read before the Association of Public Lighting Engineers at the Annual Conference held at Folkestone from Sept. 6-9.

Modern incandescent gas lamps of the inverted mantle type operate on two distinct principles, the difference being of very considerable importance. The amount of light which can be obtained from a given quantity of heat largely depends upon which of the two principles is used. In the one case the air-gas mixture contains only a proportion of the oxygen that is required for combustion, a secondary supply being required to complete combustion of the gas on the outer surface of the gas mantle fabric. In the other case, the whole of the oxygen required for complete combustion is mixed with the gas, the heat produced by its combustion being liberated wholly within the mantle. With the first system a secondary supply of air to the mantle is essential. With the second system a secondary supply of air is unnecessary and may be detrimental owing to its cooling effect.

It has been found that when the whole of the products of combustion are passed through the meshes of the mantle, particularly at a high velocity, not only is the intensity of the light emitted, per unit area of mantle surface, much greater, but the amount of light produced from a given volume of gas is also greater.

It should be noted that it is practically impossible to produce a mixture of gas and air sufficiently rich in oxygen to burn completely within the mantle by means of the kinetic energy in the gas alone at the ordinary main pressure of the order of 4 in. water column. Apart from the difficulty of entraining the necessary quantity of air, the mixture must be produced at a pressure sufficient to overcome the resistance of the mantle, and the velocity of the flow of the mixture through the burner system must be high enough to prevent firing back. In order to satisfy this last requirement, the velocity must be considerably greater than that of the rate of propagation of flame through such a mixture, especially when pre-heated.

All these considerations demand that some source of energy in addition to that available in the low-pressure gas mains must be employed. The most reliable and satisfactory method so far devised to meet the requirements of the more efficient system is that known as the high-pressure gas system, a compressor being employed to increase the pressure of the gas to about 80 in. water column from the normal pressure of the gas in the mains. The high-pressure gas is distributed through independent pipes, and this may be considered a drawback, but there are important compensating advantages; for instance, relatively small diameter pipes will carry relatively large volumes of gas, and any number of gas lamps may be simultaneously lighted or extinguished from a central point, by starting or stopping the pump or compressor which is used to obtain the required increase in pressure.

It may be said that the extensive adoption of the high-pressure system in all parts of the country has demonstrated that no serious difficulties are experienced with it.

## Other Methods.

Other methods of obtaining high power lighting have been tried, as, for instance, the supply of air to the lamps through special pipes under a small head of pressure; and a supply of carefully controlled mixture of air and gas in proportions below the explosive limit, known as the Selas system of lighting, has also been used. In America, Humphreys has produced a system in which a small electrically-driven fan is applied to each unit. This also has been tried on a small scale in Edinburgh, and is quite practicable, but there are, I fear, very few cases where there is sufficient co-operation between the gas and electric undertakings to permit of its general adoption.

There is, however, an alternative system which has not so far been properly tried out, but which seems to have considerable practical value. It does not require the use of a mechanically operated booster. The Author has given a great deal of thought and attention to this, and proposes in this Paper to give some details concerning it; but, before doing this, I will briefly describe the system of high-pressure gas lighting which has been successfully used for many years. The illustrations will explain some of the essential points of this system.

Fig. 1 shows the details of a single burner lamp of the suspension type.

The gas, at 3 lb. pressure from the high-pressure main, enters the lamps by way of a stirrup fitting A which carries a tube B which is removable to allow easy withdrawal of the nipple holder C for cleaning when necessary. The correctly formed venturi tube D enables the jet of gas to entrain all the air required for the complete combustion of the gas. The pressure of the gas and air mixture at the end of the venturi is sufficient to overcome the resistance of the parts of the gas-burner system, including the mantle. A screw E, adjustable from the outside of the lamp casing, is provided to enable adjustment of the quality of the mixture to be made, the air to gas ratio being dependent upon the resistance to the flow. This is necessary in order to attain the best possible lighting effect.

It is to be noted that the injector is capable of producing a mixture with an excess of air when the lamp is fully heated and the adjusting screw is open to the full extent. This allows the necessary adjustment to be made when the

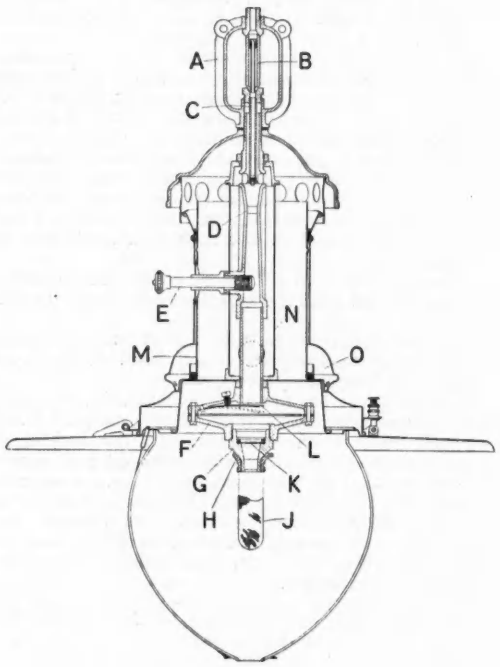



Fig. 1

lamp has reached normal working conditions by screwing E inwards. The heater F, with its burner nozzle G, is a most important component of the lamp. It is designed to allow the gas-air mixture to be heated by the hot gases leaving the incandescent mantle. This heater, or heat interchanger, paradoxically as it may seem, serves also to keep the burner nozzle cool—or, at least, keeps it from becoming heated to an undesirable temperature. This is effected by the rapid conduction of heat from the nozzle to the body of the heater through which the combustible mixture flows on its way to the burner head. To aid the conduction of the heat from the end of the nozzle, the latter is of heavy section and is made of metal having good heat-conducting properties. The absorption of too much heat by the metal nozzle is prevented by surrounding it with a close fitting clay ring H. To this ring the mantle J is attached, and the clay ring is screwed on to the nozzle flame-tight. The nozzle is always the hottest portion of the burner, but with the arrangement described its temperature is kept below the ignition temperature of the combustible mixture, and, provided this temperature is not exceeded, the hotter the nozzle the greater will be the light from the mantle.

## Removing Turbulence.

So that it may burn quietly, it is important to remove turbulence in the air-gas mixture before it issues from the nozzle. Eddying also increases the tendency for the flame to "strike back" into the heater. The heater F is formed of two dished cast-iron plates between which is clamped a metal diaphragm which is provided with a number of small holes near its periphery. When the mixture issues from the lower end of the venturi tube there is considerable turbulence, but in its passage over the diaphragm and through the small holes this is damped down. Any remaining turbulence is removed by means of a metal gauze K in the nozzle itself. This gauze also serves to prevent possible flash back of the flame on extinction, which might

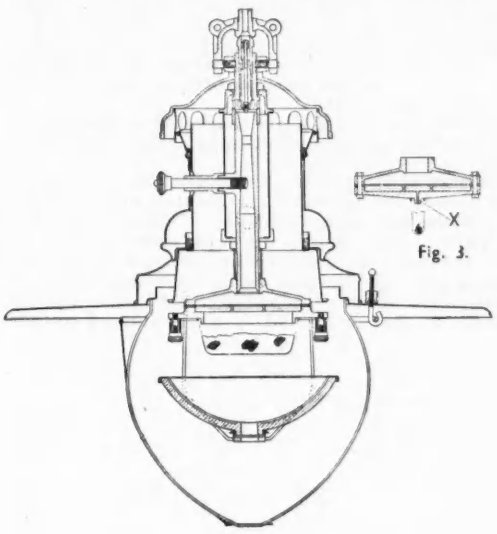



Fig. 3.

Fig. 2.

damage the mantle. It has already been noted that for the development of the maximum light the ideal mixture is one in which the correct amount of air is mixed with the gas for its complete combustion, and with such a mixture the speed of the propagation of the flame through it is also at its maximum. Therefore, the special precautions indicated must be taken to prevent the flame striking back.

The mantle, which is tied to the clay ring, is not incinerated until it has been screwed on to the metal nozzle. When first "burnt off" the fabric is in its most fragile condition, and it is, therefore, desirable to light the burner with a deficiency of air in the mixture, which gives gentle ignition. To avoid upsetting the quality of the combustible mixture by operating the adjusting screw, when re-mantling is necessary, a metal disc L, attached to the end of a bi-metal strip, is provided in the upper half of the heater. When the lamp is cold this disc offers resistance to the flow of the air; but when the heater is warmed the strip carrying the disc bends back and allows the proper quantity of air to flow with the gas. The time taken for this operation is only a few minutes.

The lamp casing consists of an inner cylindrical body M fitted with a transverse box N, and made usually of stainless steel. This material has been found to be the best for withstanding the high temperature and the corrosion due to condensation in the first minutes of lighting. The transverse box is connected with the air inlet chamber O of the lamp and closed off otherwise from the chimney, so that the injector which it surrounds can only draw fresh air warmed by the products of combustion which pass up the spaces between the box and the cylindrical body.

I wish to point out a feature of the ventilation system which differs from that in the usual design of low-pressure lamp. In the latter it is essential to balance the air inlet of the injector with the pressure existing in the globe to prevent wind action upsetting the mixture, and it is also necessary to provide for a flow of secondary air into the globe. The earlier high-pressure lamps were made in this manner, but it was later found by experience to be better to draw the air supply direct from the outside, and to provide no secondary air to the globe.

Fig. 2 shows a lamp with an important modification of the shape of the incandescent mantle. This innovation is due to the South Metropolitan Gas Company. Details of this new type of mantle, with its special slit burner, were given to your Association two years ago in a Paper by Mr. Dean Chandler and Mr. Prestage. The mantle, in shape, is like a flat bag. The flat sides are kept from blowing out by cross stitches inside the mantle. The flat surfaces of the mantle are arranged to face up and down the street so that most of the light is given in the direction where it is needed. There is a point about this new type of lamp which I do not think has been touched upon. With it there is an increase in the flux of light above that obtained with the ordinary cylindrical mantle for a given gas consumption. The Author's opinion is that this is due to two factors, both of which contribute to an increased pre-heating of the combustible mixture, particularly just before combustion takes place. As can be seen in the detail fig. 3, the mantle is fixed closer to the underside of the heater, so that the latter receives more heat by radiation and also by flame contact. The mixture, in passing through the narrow slit X, is more highly heated throughout than is possible in the final stage of heating in a cylindrical nozzle. Added to all this, the margin of safety against lighting back, even with this higher pre-heating, is increased because of the narrowness of the slit.

Fig. 4 shows a special high-pressure unit designed to project a beam of light for floodlighting purposes. It was originally devised in co-operation with Mr. Holton, of Manchester, for the illumination of the Manchester Cenotaph. The unit consists of a parabolic metal reflector at the focus of which is placed the incandescent mantle enclosed in a fused silica cup. This prevents the tarnishing of the polished surface of the reflector and also protects the mantle. The products of combustion of the gas pass over the pre-heater at the back, where they are discharged to atmosphere. The reflector and mantle may be moved through a fairly wide angle. This lamp, which is generally operated by "high-pressure" gas, may, alternatively, be provided with a small motor-driven fan attached to the unit to supply air under pressure.

## The Lucas Lamp.

I now come to the consideration of a lamp to which passing reference has already been made. It embodies a principle which makes it possible to produce with low-pressure gas a lighting unit approaching in power that realized with high-pressure gas, and of an efficiency considerably higher than that obtained by the usual low-pressure gas lamp. It is to be noted that before the advent

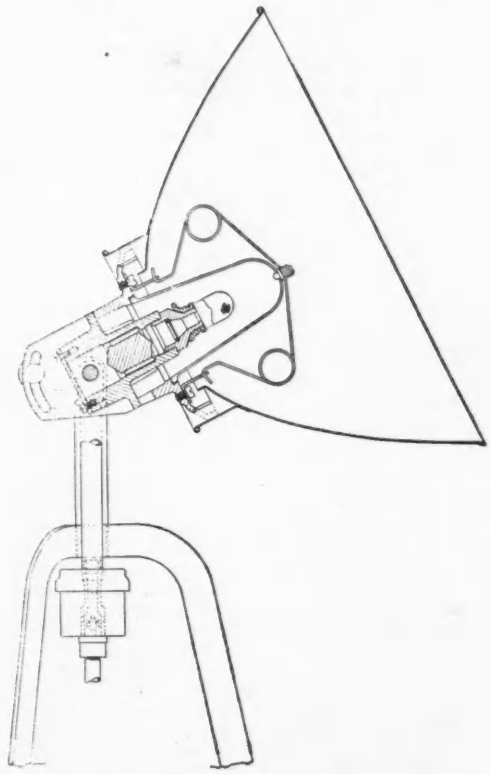


Fig. 4.

of the inverted gas mantle Lucas designed a lamp to give "intensified" light with the upright incandescent burner, and for this purpose he used a long chimney to give a "pull" on the burner. With the use of the long chimney Lucas found that it was possible to work with a more highly aerated combustible mixture which gave more light from the mantle. The upright Lucas lamp was very successful for use indoors, and although for out-of-doors

it was somewhat sensitive to wind, a considerable number were used for public lighting in its day. The advent of the inverted mantle and inverted gas burner with its higher lighting efficiency caused the Lucas upright lamp to be superseded. Lucas then turned his attention to the application of the chimney pull principle to the inverted burner and mantle; but, it appears, without much success —at least, so far as outdoor gas lamps were concerned.

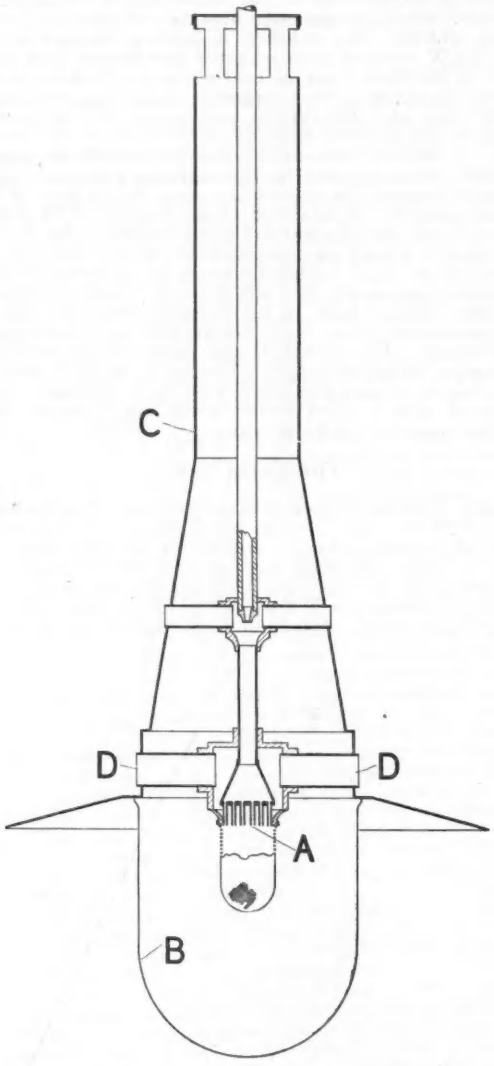



Fig. 5.

Fig. 5 is a diagram reproduced from the Lucas specification which shows a lamp obviously designed for indoor use. The special feature of this lamp was a burner consisting of a bunch of small bore metal tubes A through which the combustible mixture of air and gas passed, and from the lower ends of which it issued to be burnt. The burner and mantle were enclosed in an air-tight globe B, and a long chimney C produced the pull required to induce secondary air to be drawn in at D and to pass between the tubes, thus supplying the extra amount of air necessary for complete combustion of the gas inside the mantle. So far as the author is aware, a lamp for outdoor use working on these principles has not been successfully produced hitherto, and he has often in the past wondered why it had not been developed. Therefore, experiments were begun to discover, if possible, the points to be observed in the design and construction of inverted gas lamps for outside use embodying what might be called the mitrailleuse burner head principle operated by chimney suction. Many experiments were made which, for the most part, were disappointing. Eventually a lamp was produced which gave very encouraging results when used indoors. However, as soon as it was tested in the open air a slight wind upset the steadiness of the light. In an endeavour to get over this difficulty, all the proposals shown in the various specifications of Lucas were tried in turn, but none of them proved satisfactory. In casting about for a remedy, a different method of causing the secondary air to enter the spaces between the tubes was tried with success. This, in effect, is a device which *pushes* the secondary air into the spaces instead of pulling it through by the suction of the chimney. In its application the chimney's suction is cancelled out, so that it does not matter how this is increased or diminished by the wind effect. The result is that the lamp is wind-proof. The device also has the advantage that it still functions if the globe breaks, which is not the case with the Lucas principle.

Fig. 6 is a diagram showing the principle of the new lamp, and the operation is as follows:

A is a mantle, or one of a row of mantles.
B is a bunch of small tubes surrounded by a refractory mantle ring which fits closely to the heater body C.
The tubes B are fed with a mixture of gas and air having as high a proportion of oxygen as can be obtained by means of the low-pressure gas injector which feeds the chamber D.
The two chambers E E are connected to the space around and between the small tubes of the bunch B.

The crux of the problem is to cause the secondary air to enter this space against the resistance of the mantle and without the pull of the chimney. Surrounding the chimney body of the lamp is an outer chamber F similar to that used with an ordinary low-pressure lamp, which is supplied with air through baffled openings above the reflector. This chamber is not connected directly with the globe G, so that no secondary air is allowed to enter the

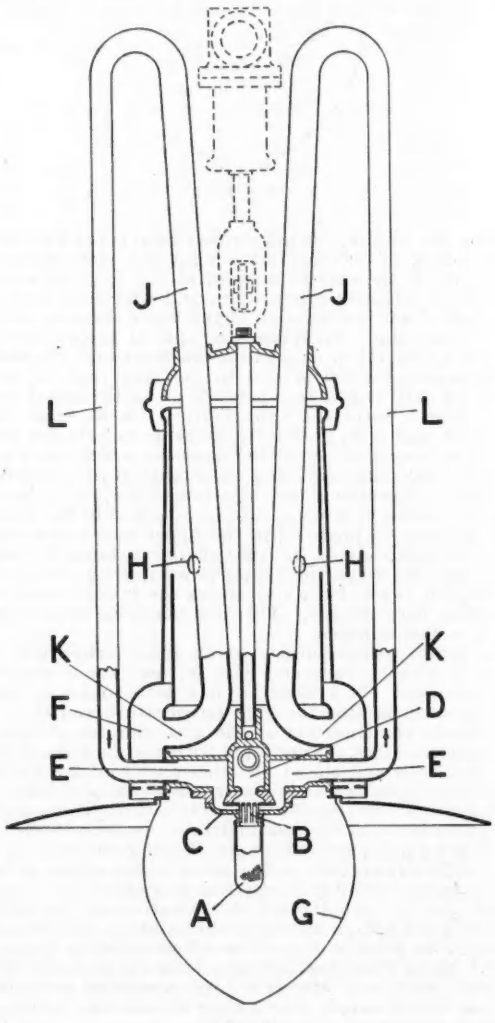



Fig. 6.

globe, contrary to the practice in normal low-pressure lamps. The chamber communicates at the top with the chimney by means of the openings H H, so that the static pressure in the chamber is approximately the same as that in the chimney. Two uprising tubes J J are connected to the chamber F by the bends K K. These tubes, which have

internal spiral strips to facilitate heat transmission, rise through the chimney and are carried through the cowl and upwards for an appreciable distance. Return bends on the top are connected to two descending tubes L L, the lower parts of which enter, by bends and horizontal tubes, the chambers E E. These tubular systems form syphons which operate by the fact that the air in the rising members is heated by the chimney gases and in the descending members is cooled by exposure to the outside air. In this way a slight pressure above atmosphere is set up at the foot of the descending tube. By this means a supply of secondary air reaches the burning mixture, which issues from the tubes B, in quantity slightly in excess of that required for complete combustion, and at a sufficient pressure to overcome the mantle resistance. A simple adjusting device is used to enrich slightly the primary mixture issuing from tubes B until the full lighting effect is obtained.

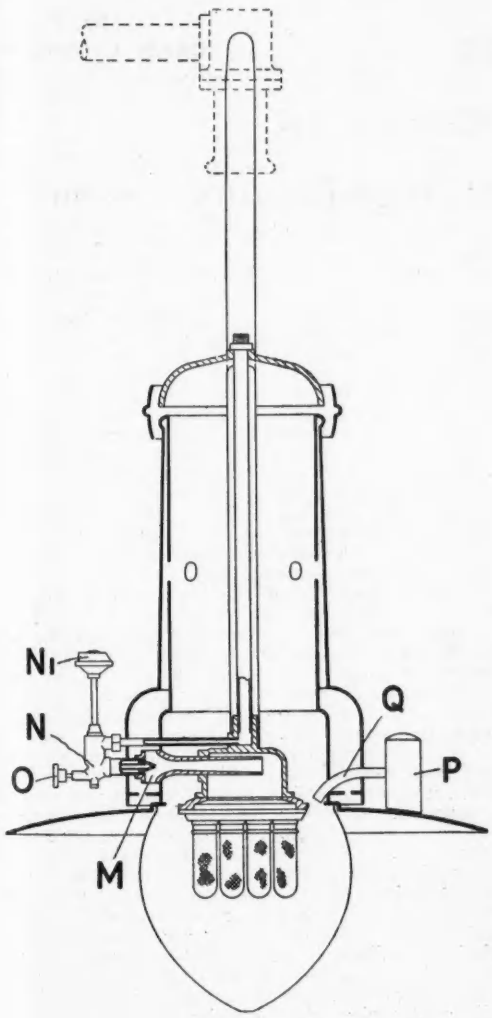



Fig. 7.

The important point to note is that no matter how the suction of the main chimney is increased or reduced by the wind, it can have no influence on the pressure difference set up by the syphons, as their inlets in the chamber F, and their outlets in the globe G, are exposed to the same static pressure, and the pressure difference is entirely a matter of temperature difference between the upcomer and downcomer legs of the syphon.

Fig. 7 gives a section at right angles to that shown in fig. 6, and shows a row of mantles intended to be disposed broadside to the length of the street. The construction of the burner lends itself to this arrangement, which has obvious advantages for street lighting. In practice, this effect may be increased by the use of a dish refractor.

This section also shows the injector M providing the primary mixture. The gas supply is brought down the centre of the lamp in the usual way, and passes through a special form of auto-lighter N to the gas nipple. As this auto-lighter deals with hot gas, the leather diaphragm which operates it is carried in a case $N^1$ on top of a tube sufficiently high to insulate it from the heat. The auto-lighter is also arranged to provide an extra supply of gas to enrich the primary mixture at the moment of lighting and extinguishing, to prevent lighting back or explosion of the primary mixture in the burner body.

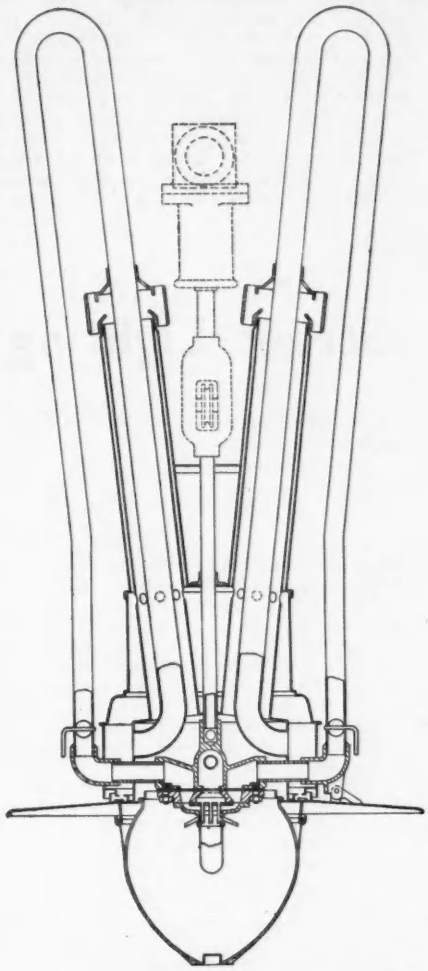


Fig. 8.

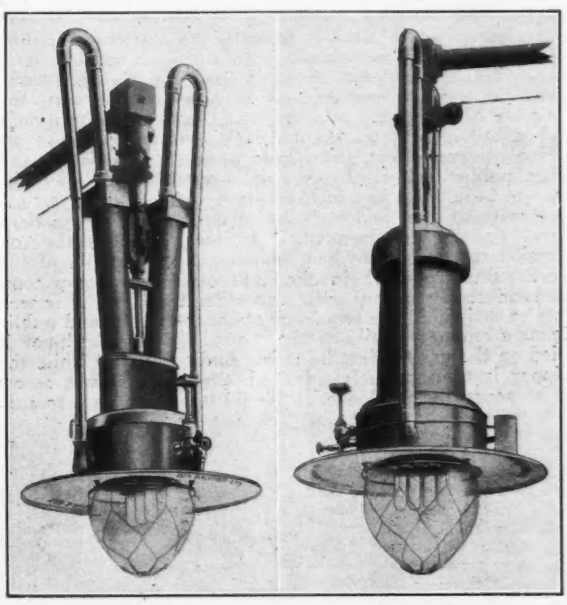


Fig. 9.—Showing the appearance of the new Keith Lamp.

Adjustment of the quality of the mixture is made by the needle valve O, the opening of which permits a small pro-

portion of gas to be admitted without entraining air so as suitably to enrich the mixture to give the optimum lighting effect.

On the other side of the lamp body a box P is carried containing a Horstmann electric igniter of the Comet type, and its battery. The filament portion of this is carried on the end of a small tube with its connecting wires and passed down to the lower end of a curved tube Q into such a position as to enable a jet to shoot down to the mantles. By this means the filament portion is protected from excessive heating, being always in a slight current of air drawn through the tube Q by the chimney suction.

Fig. 8 shows, in greater detail, a modification of the design illustrated in diagrammatic form by figs. 6 and 7. The main difference is that the chimney is divided, which enables the mantles to be raised nearer to the suspension point, so that this distance is no greater than in standard low-pressure lamps, and may be even less. In both designs the syphon tubes are arranged to straddle the bracket or other means of suspension, so that their length does not count in the length from the point of suspension. At first sight these long tubes present an unusual appearance, but when the lamp is in position, with the mantles about 25 ft. from the ground, they are not obtrusive.

It is, I believe, generally accepted that the light output of a good low-pressure lamp, using gas at 500 B.Th.U., is about 200 lumens per cu.ft. of gas, and that the light output of a good high-pressure lamp is about 350 lumens per cu.ft. In a recent independent test of the lamp just described the output was given as 300 lumens per cu.ft.

# Street Lighting by Gas

## With Special Reference to The High-Pressure System

by
**DEAN CHANDLER**
(of the South Metropolitan Gas Company

From a Paper presented to the Annual Conference of the Association of Public Lighting Engineers at Folkestone from Sept. 6-9.

Gas as a lighting medium has been a much maligned commodity and it is not to be denied that some of the criticism which has been levelled at it has been deserved. But this criticism requires some qualification, for it was not so much the gas as the gas-burning appliances which were at fault. The gas burners and gas lamps which were in use a decade ago in many parts of the country were for the most part indifferently made and badly maintained. This did much to discredit gas lighting and influenced public opinion against it. In more recent times the position has been entirely changed, owing to the attention given to detail and to the skill and ingenuity displayed by gas engineers and lamp makers, so that to-day street lighting by gas plays, and will continue to play, an important part in the service of the community.

As regards the quality of the light from the incandescence gas mantle, I think it will not be contended that it is in any respect inferior to the quality of the light from other sources. The discolouring of ceilings by dust deposited from the heated air does not arise in the use of gas in the street, and the "convenience" factor has no point or force where gas is used for public lighting. As to the quality of the light, there is, I think, something to be said in favour of the light of the incandescence gas mantle.

Sentiment is not allowed to influence matters of public service, and it is perhaps well that this is so, but it is surely not inappropriate to say that the Gas Industry, which for over a century has been associated with the civic life of the community and has rendered it continuous and unfailing service, should have reasonable treatment and consideration at the hands of local authorities and other public bodies. I say this, because there does appear to be a tendency in these days to look upon the gas light with disdain and as being incompatible with modern street lighting requirements. In fact, one has the impression that gas is looked upon as the Cinderella of the piece. But the truth is, the light of the gas lamp compares most favourably with any other light and it is well able to satisfy all the requirements of the public and public lighting engineers. When the "good lighting" slipper is tried on the gas Cinderella, it is found to fit, but while the slipper is then publicly admired, Cinderella's part seems to be generally overlooked. Would it be invidious to suggest that sometimes, indeed, Cinderella becomes discredited in the process?

There is, I believe, to-day a widespread opinion that gas lighting is about to make its final bow, and it will not be long before it is remembered only as "the light of other days." This in no small measure is due to the fact that, in these days fashion, fancy, and even prejudice, and not intrinsic merit and ultimate worth, are the factors which largely dominate and influence the public in its choices, and this, of course, is true in the choice of light as in other things.

It has been stated recently that the passing of the gas light is a "dead certainty." Mr. Chesterton once wittily declared that all certainties are "dead certainties." I recall that half a century ago the death sentence of the gas light was solemnly pronounced.

That gas lighting is not the back number that some engineers are inclined to believe is suggested by Table 1, which shows the steady progress of gas lighting in the streets of South London over a period of years. Most of the important main roads in South London are lighted with high-pressure incandescent gas lamps.

The term "high-pressure" as applied to gas supply is a comparative term only. The science of gas supply has advanced rapidly in recent years and conditions have changed from year to year. With the introduction of the incandescent mantle nearly half a century ago gas pressure became at once a matter of great importance. At first 1½ in. of water column pressure was spoken of as a suitable pressure for the Welsbach light, but it soon became evident that better results could be obtained with higher pressures. Again conditions changed when the inverted burner and mantle were introduced. With this type of lighting appliance 3 in. water column pressure was desirable. Then it was found that great advantages in the matter of special gas lighting would accrue from the use of pressures much in excess of those at which gas was distributed through the mains to consumers for the normal household requirements.

### An Important Stage.

The important stage in the development of high pressure, or as it is sometimes called "intensified," gas light-

TABLE 1.

| Year. | Number of Public Lamps. | Gas Consumption (Millions Therms per Annum). | Equivalent Candle Power per Hour. | Candle Power per Cu.Ft. of Gas Consumed per Hour. | Remarks. |
|---|---|---|---|---|---|
| 1899 . . | 20,998 | 2·677 | 280,000 | 2·5 | Flat flame burners throughout district. |
| 1902 . . | 21,800 | 2·010 | 1,196,000 | 14·0 | Upright incandescent burners throughout district. |
| 1913 . . | 24,713 | 2·081 | 1,700,000 | 19·0 | 8,000 upright burners replaced by inverted incandescent burners. |
| 1930 . . | 25,268 | 2·154 | 2 290,000 | 25·0 | Horizontal preheater cluster units, with medium size inverted mantles. |
| 1932 . . | 23,447 | 2·530 | 3,453 000 | 32·0 | This includes 21 miles of lighting by 800–1,000 candle-power high pressure lamps. |
| 1936 . . | 19,980 | 2·825 | 5,104,000 | 42·5 | This includes 73 miles of lighting by high pressure lamps. |

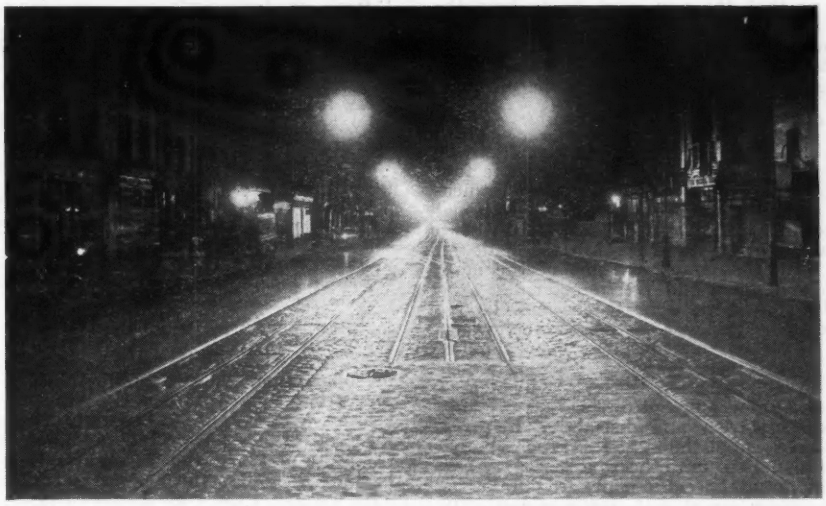


Fig. 1.—High Pressure Gas Lighting by "Supervia" Lamps in Blackfriars Road, South London. B.S.I., Class C.

ing dates from the time when the gas pressure was raised to about 8 in. water column pressure by mechanical contrivances—the earliest being water-driven pumps—the object of which was to increase the velocity, and therefore the kinetic energy, of the stream of gas issuing from the gas nipple orifice into the mixing tube of the burner. The energy of the higher pressure gas jet entrained a greater volume of air than was possible with the lower gas pressure and "this resulted in a hotter flame and a greater intensity in the incandescence of the gas mantle."

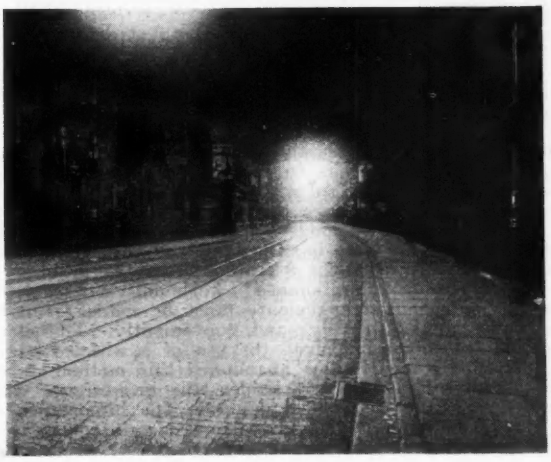


Fig. 2.—High Pressure Gas Lighting by "Supervia" Lamps in South Street, South London. B.S.I., Class D.

This simple explanation of the intensifying process must suffice here, as it has been more fully treated in another contribution to your proceedings by an author whose name is practically a synonym for high-pressure gas lighting almost everywhere in the world where such lighting is used. What Mr. George Keith does not know concerning high-pressure gas lamps and burners is hardly worth the knowing. This provides a fitting occasion for acknowledging the great services which Mr. Keith has rendered not only to the Gas Industry, but to the community for nearly 40 years, and I am glad to have this opportunity of paying my tribute.

In 1896 Somzee and Greyson, of Belgium, were, I believe, the first to construct a water-driven compressor to increase the pressure of the gas to about 8 in. water column, and their special pump functioned satisfactorily, making possible an increased lighting efficiency. In the following year Mr. Keith introduced a water-driven compressor which also raised the gas pressure to about 8 in. water column. The name of William Sugg must not be overlooked, as it was Sugg who first used a gas-heated hot air engine to drive a gas compressor which worked for many years in the Tottenham district. This machine was less clumsy than Greyson's and it was simpler in operation.

About the same time Scott-Snell introduced a novel and ingenious gas pressure raising device. He provided in the tent of the gas lamp above the gas burner a hot air motor, which was actuated by the hot products from the combustion of the gas. The gas on its way to the burner passed through a chamber which contained a "displacer," the operation of which raised the pressure of the gas to about 10 in. water column. At this pressure the gas was then conveyed by a pipe to the gas ejector provided at the base of the burner. The gas issued from the ejector at high velocity, entraining thereby a considerable proportion of the air required for its combustion. The gas pressure raising mechanism continued to operate so long as the gas continued to burn. The system was later modified so that the air required for the combustion of the gas was compressed to about 1 lb. per sq.in., the gas being used at the normal supply pressure. Scott-Snell lamps were used in Parliament Street and for the lighting of the old Vauxhall Bridge.

Other methods were employed for obtaining more light from the incandescent mantle. Lucas discovered that "the flame of a Bunsen burner had the most intense effect upon a gas mantle when about five parts of air were added to the gas before combustion." Lucas achieved the "intensified" effect by the use of a long chimney with the burner enclosed in a glass container almost hermetically sealed.

The Lucas upright gas mantle system of lighting proved a great attraction to many public lighting authorities who visited the Friedrichstrasse to see the striking effect produced by the novel lights. Other lamp designs followed the lines of Lucas' with more or less success. Typical of these is the Welsbach "self-intensifying" lamp.

The great step forward occurred when Mr. George Keith introduced the now famous Keith Inverted High-Pressure Gas Lamp, in which some of the heat from the hot products of the combustion of the gas was given to the gas-air

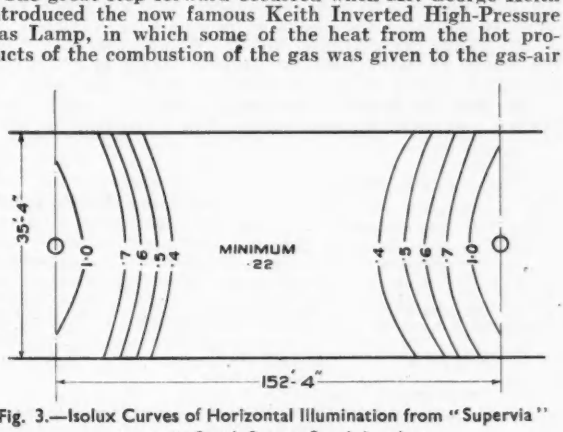



Fig. 3.—Isolux Curves of Horizontal Illumination from "Supervia" Lamps in South Street, South London.

mixture by means of a special heat interchanger. This was a radical departure from the accepted theory that to work satisfactorily the burner of a high-pressure gas lamp had to be kept as cool as possible by carefully avoiding any "pre-heating," as we now understand it, of the combustible mixture. Up to the time of Mr. Keith's discovery this now discarded theory was the basis of lamp design on the Continent, particularly in Germany. It was Mr. Keith,

then, who showed us that the aim must be to heat the mixture to within a few degrees of its ignition temperature, and at the same time he showed how it was possible under these conditions to keep the burner nozzle from becoming hot enough to cause pre-ignition of the mixture.

## Impressive Display.

These lamps made it possible to obtain from 50 to 60 candle power in the horizontal plane for each cubic foot of gas burned. They were first exhibited at the Franco-British Exhibition in 1908 and at the Scottish National Exhibition at Edinburgh in the same year. About two years later the Gas Light and Coke Company made an impressive display with the lamps in some of the main streets of the cities of London and Westminster.

To ensure that full justice be done to the new lamps, Mr. Keith developed his Rotary Gas Compressor, whose performance gave a notable improvement over that of existing types.

Two years ago in collaboration with a colleague I brought to your notice a development of the high pressure gas lamp which possessed new and distinctive features. I may remind you that some of the light from the cylindrical high pressure gas mantle must be re-directed, generally with the aid of auxiliary equipment, to obtain the best light distribution for street lighting purposes. We took the view that much of this redistribution could be simply effected by so altering the shape of the mantle itself that a greater proportion of the luminous output was radiated in the direction in which the greatest intensity of illumination was required. This simple and valuable expedient was adopted in the Supervia lamp, and there are now in use in South London 1,800 Supervia lamps out of the 2,700 high pressure lamps lighting nearly 73 miles of roads.

TABLE 2.—*High Pressure Gas Public Lighting in South London.*

| — | No. of Lamps. | | Supervia Lamps. | Total. | Mileage. |
|---|---|---|---|---|---|
| | Central. | Gibbet. | | | |
| Camberwell . . | 398 | 6 | 17 | 404 | 10·78 |
| Deptford . . . | 115 | 33 | 35 | 148 | 3·92 |
| Greenwich . . . | 230 | 23 | 77 | 253 | 7·24 |
| Lambeth . . . | 100 | 799 | 899 | 899 | 24·49 |
| Lewisham . . . | 164 | 13 | 29 | 177 | 5·39 |
| Southwark . . . | 177 | 36 | 155 | 213 | 3·70 |
| Wandsworth . . | .. | 615 | 615 | 615 | 17·01 |
| | 1,184 | 1,525 | 1,827 | 2,709 | 72·53 |

The Supervia lamps provide exceptionally good distribution of the light over the road surface (as shown by the photographs in figs. 1 and 2 and the Isolux Diagram, fig. 3).

The character of the illumination on the surface of the road is in accordance with the views expressed by the Departmental Committee on Street Lighting.

The "pools of darkness" resulting from uneven distribution of light on the road surface make it difficult for the motorist to judge distances and for other road users to estimate the speed of approaching vehicles. It is an interesting comment by the Committee that "On the whole we agree with the opinion which has been advanced by more than one witness that street lighting which may be described as patchy may be worse from the point of view of public safety than no lighting at all." "Pools of darkness" are conspicuous by their absence where the Supervia gas lamp is used.

There is one point about lamps operating on a high pressure gas system which is of definite advantage, and in certain circumstances of very great importance. I refer to the ease and rapidity with which all the lamps may be turned on or off by the very simple process of starting or stopping the gas compressor. The value of this facility in times of emergency cannot be over-estimated. In this connection it must be remembered that the high pressure system is an independent system, and its interruption, therefore, in no way interferes with the supply of low pressure gas to houses, workshops, offices, and factories.

Before I pass to a brief description of the high pressure system as it operates in South London, I may anticipate a question which I think is bound to come up, and that is the cost of lighting by high pressure gas lamps as compared with that of alternative systems. This is, of course, of some importance to public lighting engineers. I do not propose to consider the matter in any detail, for reasons which you will readily understand. I suppose the crux of the matter is: Can the lighting of the streets by high pressure gas be undertaken on a competitive basis? I suggest the answer is to appeal to experience. You will not expect me to give chapter and verse for the following statement, but you may take it that the facts are precisely as I give them to you. Recently, two tenders for the lighting of a borough of considerable size were submitted to the appropriate authority for installations giving the same class of lighting. When the two tenders were in due course opened they were within a few pounds of each other. I may tell you that the gas tender had been prepared on a strictly economic basis. The day has gone when gas lighting in the streets of South London can be provided at uneconomic rates. The lighting of the highways must be carried out on sound financial lines. Any other method cannot be justified on any grounds.

## Equipping a High-Pressure Installation.

A brief description of the equipment for a high pressure gas installation may be of interest. The lamp is the obvious starting-point, but I propose to omit this, as it is dealt with in another Paper which is being presented to you. Suffice it to say that the lamp is a self-contained unit, which only needs to be properly connected to a suitable gas pipe supplied with gas from the high pressure mains.

In accordance with modern street lighting practice the high pressure gas lamp is suspended over the carriageway either centrally or about 8 ft. out from the kerbline.

Cleaning and "maintenance" work must be regularly carried out, and arrangements must be made for it to be done safely, speedily, and conveniently. The older method, of course, involved the use of a wheeled tower ladder, but we have now abandoned this method owing to the unwieldiness of the ladder, the interference with traffic, and the element of danger. The importance of the last two items is evident, when it is pointed out that the lamps are cleaned on an average once a week. Instead of the attendant going up to the lamp, the lamp is now brought down to the attendant by a simple, ingenious, and reliable mechanical arrangement.

Our high pressure gas system is arranged to give a gas pressure of 81 in. water column, or approximately 3 lb. per sq.in. at the lamps. As high pressure gas lighting from road mains in South London was used for the

TABLE 3.—*High Pressure Gas Public Lighting.*

| Borough. | Street or District. | System of Lighting. | Type of Lamp. | Mileage. | Mounting Height. | Spacing. | B.S.I. Specification. |
|---|---|---|---|---|---|---|---|
| | | | | | Ft. | Ft. | |
| Southwark . . | Blackfriars Road . . | Centrally suspended units, two lamps per span | Supervia | 0·63 | 22½ | 100 | Class C |
| Southwark . . | Borough High Street . | Staggered | ,, | 0·42 | 25 | 100 | Class C |
| Lewisham . . . | Lewisham Road . . . Blackheath Hill . . . | Centrally suspended one lamp per span | ,, | 3·09 | 22½ | 150 | Class D |
| Greenwich . . | South Street . . . . | | | | | | |
| Southwark . . | Woolwich Road . . . Marshalsea Road . . Southwark Bridge Road | | | | | | |
| Wandsworth . . | All main roads . . . | Staggered | ,, | 17·01 | 25 | 150 | Generous Class E |
| Lambeth . . . | All main roads . . . | Staggered | ,, | 24·49 | 18–25 | 150–180 | Class E |
| Lewisham . . . | Canadian Avenue . . | Centrally suspended | ,, | 0·43 | 22½ | 180 | Class E |
| Camberwell . . Deptford . . . Lewisham . . . Southwark . . Greenwich . . | Main roads . . . . | Centrally suspended | Keith 1,000 c.p. | 26·46 | 18–22 | 150–180 | Class F |

Fig. 4.—High Pressure Gas Public and Parade Lighting in Camberwell, South London.

outside lighting of shops only, our system was built up around the busy shopping centres, each local high pressure mains network being supplied from a small compressor station. Three of these local independent systems still remain.

The demand for improved public lighting, however, has necessitated a rapid development of the high pressure mains system until now all but three of our ten compressor stations are interconnected. Our latest Kennington compressor station will, with another large station, eventually supersede the small local stations. The ten compressor stations have a maximum output of 1,500 therms, or 268,000 cu.ft., of gas an hour. This figure is high in consideration of the lower actual demand, but it must be remembered that complete duplication was necessary with the older independent stations to ensure continuity of supply. With interconnection of the stations, of course, the need for duplication is lessened. Our compressors are all gas engine driven, and a total of 237 horse-power is available. At present the maximum hourly gas rate for the high pressure lamps is 760 therms, or 135,500 cu.ft., but this consumption includes the gas taken by lamps on shop fascias and "parade" installations.

### Extension of the System.

With the greatly increased use of high pressure gas lamps for street lighting our high pressure mains are no longer restricted to the busy shopping streets, but now extend through main roads, carrying trams or 'buses or both, to certain purely residential roads. A high standard of illumination has become necessary in these last roads, which were originally used by private traffic as "short cuts" or unofficial "by-passes" round busy centres, but which now carry such a heavy volume of private traffic that from the street lighting point of view they have to be treated as a special case. Our high pressure mains system consists of 8½ miles of 2 in. pipe, nearly 28 miles of 3 in., nearly 29 miles of 4 in., one-third of a mile of 5 in., 43¾ miles of 6 in., 8 miles of 7 in., 1 mile of 8 in., and one-quarter of a mile of 10 in. and 12 in., making up a total of about 119 miles of pipe. This figure, of course, greatly exceeds the length of road which has high pressure street lighting—nearly 73 miles—as most of the important roads have a main down either side under the footway to prevent interference with traffic in main-laying or the making of new connections.

Although my remarks are naturally concerned mainly with high pressure gas lighting in South London, I cannot omit reference to some very fine installations of this type in other parts of the country.

I should like to draw attention to a type of high pressure gas lighting which I mentioned in passing earlier. I refer to "parade" lighting. This is admittedly not street lighting in the accepted sense that the installation is put up and maintained by the local authority for the purpose of lighting the roadway for the safety of road users. Nevertheless the general public benefits considerably from the extra light provided by the frontages.

Fig. 4 shows a section of road with central suspension high pressure gas public lamps. At the kerbline on both sides of the road are further lamps on cables running parallel with the road and secured to the public lighting columns and subsidiary columns. I would mention that this installation was proposed by the traders themselves after the public installation had proved successful. You will notice that on the left side of the picture there is an older type of "parade" lighting for floodlighting the shop fronts. "Fascia" lamps are also visible on the cinema on the right side. These are part of the early high pressure gas shop lighting system which I mentioned as the origin of our high pressure network. I think this illustration speaks well for high pressure gas lighting, as it shows four independent systems in one road, three of the systems being paid for by private traders. The value of the newer "parade" lighting appears clearly from the following figures: the mean surface illumination of a 40-45 ft. wide section of road over one unit of system is 0·64 foot-candle, when the public lighting lamps only are used, and 2·72 foot-candles when the cable suspension private lamps are burning also.

## Gas Meter Testing in Glasgow

### Increased Work

The Chief Inspector of the Glasgow Gas Meter Testing Department, Mr. Alexander Macdiarmid, states in his annual report for the year ended May 31, 1937, that the number of meters tested was 37,333, an increase on the previous year of 2,290. The fees amounted to £2,450, compared with £2,308, an increase of £143. Of the total tested, 14,232 were new meters, 22,777 were repaired meters, and 324 were submitted on behalf of gas consumers for certification as to correctness.

# SLAGGING OF REFRACTORIES

*In this article Dr. G. E. Foxwell suggests that, although it would be unprofitable to attempt any calculations of penetration based on assumed values for the surface tension of coal ash slags, attention should be devoted to this method of attacking the problem.*

It will be remembered that a questionnaire was sent to gas undertakings asking for opinions and experiences upon matters affecting the life of retorts. A digest of the replies was published in the 25th Report of the Refractory Materials Sub-Committee, November, 1934. Under the heading "The general causes of failure of retorts," section (*b*) "vertical retorts," is the conclusion that: "The second important region where failure is reported is in the bottom courses. Here the slagging action of the coal ash, enhanced by steaming, and probably by the abrasive action of the coke, may result in the thinning of the walls and ultimately of holing." In a later section of the report, "Effects dependent on the nature of the coal," it is recorded that, in relation to vertical retorts, "steaming is not generally considered as greatly increasing the corrosion of the retort, although a significant minority think otherwise. . . . Too high bottom temperatures in conjunction with high steaming may cause disintegration. The scouring action of the coke is more pronounced in the steaming zone when ash contents are high."

A valuable general statement of fundamental principles governing the action of slags on refractories is contained in a Paper published in the Transactions of the Ceramic Society by Mr. A. E. Dodd, which, although not dealing specifically with the action of slags in gas retorts, gives rise to some reflections on the subject. Four effects are distinguished—namely, (*a*) penetration and (*b*) solution of stationary slag, (*c*) erosion by moving slag, and (*d*) physical disruption by frozen slag. It may be supposed that the first three of these reactions will affect gas retorts when in operation to varying degrees, and that the last-mentioned reaction will come into play when retorts are cooled down. Obviously the penetration of brick by slag depends upon the porosity of the brick—primarily, of course, upon the size of the pores—and upon the surface tension of the slag. The interpenetration of brick by slag is, in short, a surface tension effect, the fluid slag being drawn into the pores of the brick by the action of surface tension. The height of rise of liquid, $h$, in a narrow tube is given by the expression:

$$h = \frac{4\,t\cos a}{g\rho d}$$

where $a$ is the angle of contact between the liquid and the surface, $t$ is the surface tension of the liquid, in this instance the slag, $g$ is the acceleration due to gravity, $\rho$ is the density of the liquid, and $d$ is the diameter of the pore.

## Greater Penetration with Smaller Pores.

According to this view, the penetration of refractories by slag would appear to be the greater as the pores were smaller, since the rise of a liquid in a capillary tube varies inversely with the diameter of the tube. It must be remembered, however, that depth of penetration is only one factor, and quantity of slag penetrating is equally, or more, important. A small pore may become filled with slag, but it may therefore be rendered impervious to further slag entry, and the amount that has entered may be insufficient, even when it has reacted with the material of the refractory, to do any real damage to the structure or to become sufficiently fluid to leave the pore by convection, to be replaced by fresh slag. The rise is directly proportional to the surface tension of the fluid. So far as the writer is aware, we have no measurements of the surface tension of fused slags, but a number of figures have been published of the surface tension of fused metals and inorganic salts. The surface tension of water at atmospheric temperature is of the order of 75 dynes per cm., of alcohol 24 dynes, and of benzole 29 dynes. The surface tension of water is unusually high. When we come to the fused metals, &c., however (*c.f.* Castell-Evans, Physico-Chemical Tables), we find surface tensions of an altogether higher order; lead at 400° C. is given as 500 dynes per cm., sulphur near its melting point as 587 dynes, and gold, which has a high melting point, as 610 dynes. On the other hand the surface tensions of the fused inorganic salts are considerably lower, varying for the most part from 80 to 250 dynes per cm. There is in general a diminution of surface tension with increase of temperature, but as most slags met with in gas retorts would be at or near their melting point it may reasonably be assumed that their surface tension would be at or near the maximum. It would be unprofitable to attempt any calculations of penetration based on assumed values for the surface tension of coal ash slags, but the writer would suggest that some attention should be devoted to this method of attacking the problem.

No mention has yet been made here of the fluidity of the slag. The writer is disposed to wonder whether from the point of view of penetration it is not possible to pay too much attention to this factor. On the assumption, probably unwarranted, that the slag "wets" the capillary walls of the refractory, so that $\cos a = 1$, the height to which a fluid slag of density 2·5 would rise in a capillary of 1 mm. diameter would be approximately 1·6 cm. if its surface tension were 100, 4·8 cm. with a surface tension of 300, and 9·6 cm. with a surface tension of 600 dynes. Moreover, it must be remembered that the capillaries are not placed vertically above the slag, but horizontally or at an angle, so that the distances theoretically travelled would be greater. In practice, of course, no such distances are traversed, partly because the pores are not sufficiently continuous, and partly because the slag comes in contact with the surface in drops which do not contain sufficient material to permit of so deep penetration. Nevertheless, the fact remains that there appears to be sufficient possibility of interpenetration by the action of surface tension alone. Moreover, surface tension effects do not depend on the fluidity of the liquid. The rate at which the liquid ascends the capillary depends on fluidity, but not the total height of ascent.

## Fluidity in Slag.

That conclusion, however, does not mean that fluidity in a slag is of no importance in refractory corrosion. The rate of reaction between the slag and the refractory depends, once the slag has penetrated into the pores, on the rate at which slag molecules can be brought into contact with the surface and on the rate at which they react once they are at the surface of the brick. The rate of molecular diffusion depends on the fluidity of the liquid; moreover, when the reaction has proceeded the compounds formed may be dissolved in the slag, and thus the more fluid the slag initially the greater is the amount that can be dissolved without solidification and the greater the ultimate effect. It is to be understood that we are now considering a "neck" of slag, perhaps some 1 mm. diameter, that has penetrated into the pores of a refractory. The more fluid the material after the reaction, the greater will be its weakening effect on the structure. There will, of course, be an increasing temperature gradient from chamber to flue, and as the slag penetrates farther its temperature will rise, so that the fully reacted slag may penetrate some considerable distance.

The composition of the slag will also govern the rate of reaction between the slag molecules and the brick. A certain time of contact between molecules at the fluid-refractory interface appears to be necessary, which in practice probably means that each molecule has to be brought in contact with the interface a number of times before it happens that on one of these occasions conditions are just right for the reaction to occur. The number of contacts per unit time depends on the fluidity of the slag; the rate of reaction per unit number of collisions depends on the composition of the slag and the brick. Obviously, when the coal ash is basic and the brick is acid, the disposition for rapid reaction as just defined becomes a maximum. A fluid slag may possibly dissolve refractory from the retort walls; a basic slag will react to form fusible compounds, and that will be one reason for the varying effect of different coals. If constituents are present which lead to in-

creased surface tension, to increased fluidity, and to increased basicity, corrosion would be expected to be a maximum.

### Interchange of Atoms.

Returning now to Mr. Dodd's Paper, he refers to the fact that with silica bricks: "The lower the proportion of silica present the higher will be the proportion of melt formed within the brick at high temperatures, and the more easily will slag be absorbed by a process of liquid diffusion." The interpenetration of the slag by liquid diffusion is an interesting subject. The striking fact recently established is that there is a continual interchange of atoms between the several parts of a fused mass. In a general way that has been known for long, but the use of induced radio-active substances as an aid to analysis has enabled atomic perambulations to be shown in a striking manner. It is possible in that way to show the inter-diffusion of molten lead and even of solid lead, to study the exchange of atoms, to show that valency is not constantly attached to one atom, and a variety of similar phenomena.

The methods in use were recently described to the Society of Chemical Industry by Prof. Paneth, and it would seem that this new technique might with advantage be investigated as a possible method of studying the mechanism of slag behaviour within the brick. Briefly the method consists in "activating" an element—which in this instance could be one of the constituents of the slag—by bringing it into the presence of a neutron source. In this way a small quantity of the isotope of the element is formed, the amount of which can be measured at any given time by the velocity with which the leaves of a gold leaf electroscope close. It is possible in this way to determine amounts as little as $10^{-17}$ gramme by this method. The material is then put through whatever chemical reactions are desired and the distribution of the isotopes ascertained afterwards. The method depends on the fact that an isotope cannot be separated from its own (non-isotopic) element by chemical methods. The experimental procedure is very simple, and it should be possible to follow the penetration of slags, and the subsequent diffusion by this method, with singular accuracy and facility.

### A Frequent Source of Attack.

The difference in composition between the refractory particles and the bonding material is a frequent source of slag attack. That, as Mr. Dodd points out, is a difficulty in assessing the probable effect of slag on any brick by means of an equilibrium diagram. "Chemical analysis may place a refractory at one point on an equilibrium diagram while it should in reality be represented by two widely separated points—one being the composition point of the grog, the other of the matrix." It might be possible to gain some idea of the composition of the bond by analyzing selected fragments of obvious grog or refractory particles, and deducting the composition thus determined from the mean composition of the whole brick. If this could be done, the indications from an equilibrium diagram might be of even more value than at present. The equilibrium diagrams show clearly a fact that those who have not specialized in refractories do not always remember—namely, that certain lime-alumina-silica compounds are only stable between defined limits of composition, and frequently of temperature. The result of slag action on any brick will depend on which compounds are formed and in what proportion. Thus, when a slag having the composition of Portland cement clinker reacts with a firebrick containing 35% $Al_2O_3$, when the proportion of slag is below 30% the formation of liquid occurs at 1,380° C.; with 30 to 50% of the slag, at 1,170° C.; and with more than 50% of slag approaching 1,265° C. If the same slag be in contact with a highly aluminous brick containing 65% $Al_2O_3$, the formation of liquid appears at the following temperatures: With below 15% of slag, at 1,380° C.; with 15 to 30% of slag, at 1,512° C.; with 30 to 60% of slag, at 1,380° C.; and with 60 to 70% of slag, at 1,265° C.—further slag additions increasing the temperature of incipient fusion. There is this degree of uncertainty about any such method of examining the probabilities that the brick does not react as a whole, and the composition of the slag formed by the reaction of the foreign slag with the brick particle interfaces will be very different from the composition which would be obtained by finely pulverizing the whole of the brick mixed with the postulated amount of slag. Nevertheless, it is obvious that little damage may result from the formation of a slag melting 1,512° C. as in one of the examples given, while the retort would suffer considerably if a slag melting at 1,170° C. were formed; both of these are possible with 30% of slag. The behaviour of slagged bricks is thus seen to be similar to that of coals; it depends on the mineralogical or petrological composition, and not upon the elementary or chemical composition.

In order to investigate the behaviour of the bond, measurements are being made of the tensile stress of bricks at high temperatures. If, for example, in a brick particles of high refractoriness are held in position by a bond of lower refractoriness, attack upon the bond by slags will be more likely and more violent than if the bond had also a high refractoriness. Clearly information regarding the refractoriness of the bond, as distinct from that of the particles of the brick, will be afforded by tensile stress determinations at high temperatures.

### Effect on Jointing Material.

Finally, there is the effect of slag on the jointing material to be considered. It is evident that here, when the gap into which the slag can enter may be so much larger than in the individual pores of the solid brick, the reactions may be more disastrous and also different from those just discussed. There is the same chance for interpenetration, and there is also the chance that the slag may become lodged between the bricks if the exposed surface should be eaten away. There is also the possibility that migration of molecules may occur when the surface of the joint has been eaten away. If one imagines that the jointing material for perhaps half an inch has been replaced by a moderately fluid slag, it is easy to see that there will be, as shown by Prof. Paneth's radio-activity analysis method, continual diffusion of molecules within the slag so that fresh slag supplied from without the joint will continually be brought into contact with the inner surface of the jointing cement, and although apparently coated with slag which has completely reacted with the jointing cement that has disappeared, the inner surface is still in point of fact being attacked. Very serious effects may be set up when a joint has been entirely eaten away in this manner, permitting gases to pass through the joint into the flues and setting up local overheating, especially of the brick edges.

## Athletic and Social

### Newton-le-Willows in Push-Ball Final.

At a recent fête held at Newton-le-Willows the local Gas-Works team were successful in reaching the final of the *Daily Mail* Push-Ball Contest.

After great work by "Mr. Therm's team," the game was dramatically ended by the collapse of the ball, and it was eventually decided to share the prize of £5 with the other finalists.

### Rotherhithe's Annual Outing.

It would have been a hard quest to find a finer day than last Sunday when the Rotherhithe Co-Partnership Institute of the South Metropolitan Gas Company enjoyed to the full an outing to Arundel, where lunch and tea were taken, and Littlehampton, where there were some rare old jinks beside, and in, the sea. With the Clerk of the Weather as his right-hand man, Mr. Fred Hills was indefatigable in his attentions to the comfort and welfare of all.

The Engineer of the Rotherhithe Station, Mr. T. A. Canning, briefly addressed the company at lunch.

### Southend Mudlarks and Sports.

Once again, the Gas Light (Southend) Sports and Social Club have done their bit for the Carnival. On Saturday, Aug. 28, the Swimming Section of the Club organized a regatta, which was held on the foreshore opposite the Gas-Works. At low water there was football on the mud, the "Therms" beating the "Rag Worms" by six goals.

When the tide came in, numerous other attractions such as Walking and Climbing the Greasy Pole, Pillow Fighting, Miller *versus* Sweep, &c., were provided.

A Water Polo match between Shoebury Garrison and Leigh resulted in a win for Leigh by three goals to none. During the afternoon there was a life-saving display by the Gas Light and Southchurch Park Swimming Clubs, who demonstrated the right and wrong ways of rescuing a drowning person. Members of the Haggerston Club showed their prowess in a display of diving. Rousing cheers greeted the Carnival Queen and her Court, who were received on the barge by the Chairman of Carnival, Mr. Councillor White (Deputy Mayor of Southend) and Mrs. White, and Mr. H. M. Royle, the President of the Gas Light (Southend) Sports and Social Club. A good crowd witnessed the sports and the Carnival funds should benefit considerably by the Southend Club's activities.

# THE APPLICATION OF RAWLPLUGS TO
# Modern Fixing Practice

Mr. R. N. LeFevre, M.Inst.Gas E., A.I.Mech.E., Officer in Charge of Training, Gas Light and Coke Company, gives some useful hints on applications of Rawlplugs to modern fitting work in the Gas Industry.

(*Concluded from p. 532.*)

## Refrigerators.

The increasing popularity of the gas refrigerator has resulted in considerable installation work in this connection. Gas refrigerators are normally fitted to stand on the floor, but one small model is available specially for fitting to the wall where floor space is limited. Lugs are provided, and

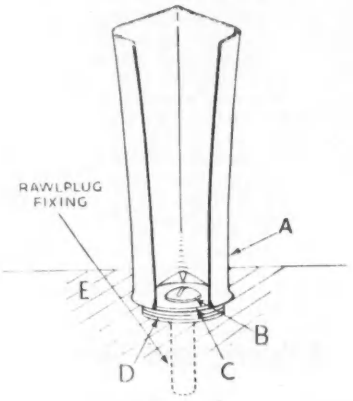



Fig. 10.

it only requires the necessary Rawlplugs and screws to make a sound, firm fixing.

When fitting a refrigerator to stand on the floor the legs should be firmly attached to the base of the cabinet by means of the screws provided. The refrigerator should be placed in position and levelled. This is very important. With the smaller sizes it is desirable not only to fit the cabinet dead level but also to prevent its being jarred or

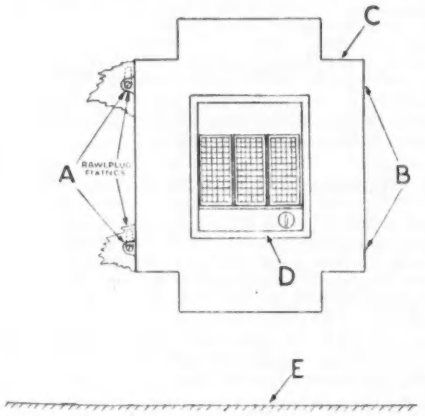



Fig. 11.

displaced when the door is slammed. To ensure a permanently rigid and level fixing the four legs should be secured by means of washers and screws.

Fig. 10 shows the inner side view of a leg of an Electrolux gas-operated refrigerator; washer, C, is slipped inside this leg, A, as shown and screwed to the floor, E. The washer should be of sufficient size to overlap the turned-in edge of the leg which, on normal wooden floors, may be held down by a $\frac{3}{4}$ in. No. 8 or No. 10 wood screw, B. On concrete or tiled floors it will, of course, be necessary to use Rawlplugs to obtain a firm fixing for the screws. If the floor be uneven the correct levelling of the cabinet may be ensured by slipping one or more washers, D, as required, underneath the legs and passing the screw through them.

## Panel Gas Fires.

The modern appearance of the panel type of gas fire is considerably enhanced by a suitable, well fitted wall plaque.

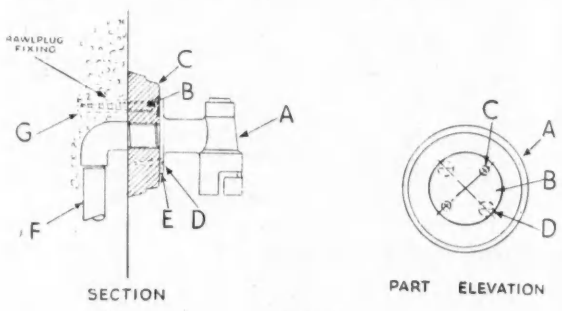
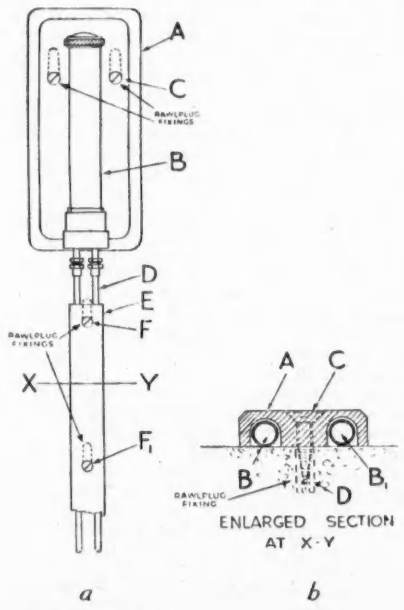



Fig. 12.

This can be had in marble, imitation marble, sprayed metal, &c. Plaques are made in a variety of shapes and designs, but all have lugs for fixing to the wall. In new premises, the plaque should, if possible, be fitted before the wall is plastered.

In fig. 11 the plaque, C, is shown at a suitable height




*a* *b*

Fig. 13*a*. Fig. 13*b*.

above the floor-line, E. It must not be too low or the effect from the points of view of both the heating and the appearance will be lost. The lugs are shown at A where the plaster is cut away. When plastering is finished they are concealed as at B. The panel gas fire, D, bolts to a frame built into the brickwork opening in the centre of the plaque. 2 in. No. 12 Rawlplugs should be used, particularly for a marble plaque which is somewhat heavy.

### Plug-in Gas Points.

The gas plug and socket connection is now being fitted as a standard part of the gas equipment of new houses. It can be used to plug in all types of portable appliance and is standardized by British Standard Specification so that interchangeability of plug and socket will be universal. The wall type shown in fig. 12 calls for sturdy fixing, as it will be subjected to frequent and often hard usage. No better method of fixing can be obtained than to screw the socket to a hard-wood block which has been properly attached to the wall by means of Rawlplugs. The gas supply, F, is chased in the wall and terminates in an elbow and nipple. The block, C, is slipped over the nipple and screwed to the wall by means of the 2 in. No. 8 counter-sunk wood screws, B, and the Rawlplugs, G. The plug-in socket connection, A, is now secured to the block by means of ¾ in. No. 6 screws, D, passed through the flange, E, of the fitting. The block and the flange each have two holes. When fitting the block care must be taken to ensure that the holes, D, in the block, A (see the elevation), do not coincide with the holes, C, in the flange, B, as otherwise the small screws will foul the heads of the long ones holding the block.

### Room Thermostats.

A typical example of a room thermostat is shown in fig. 13*a*. The thermostat, B, is mounted on a metal back plate, A, which is attached to the wall by screws through the two holes, C. No. 8 Rawlplugs should be used to give a firm fixing for the screws.

The thermostat is connected to the relay valve on the main gas supply by means of two small-bore copper tubes, D. These tubes are best attached to the wall by means of the wood casing, E, and the screws, F, $F_1$. An enlarged section of this casing is shown in fig. 13*b*. The casing, A, is drilled and countersunk at C and is grooved exactly to fit the copper tubes, B, $B_1$. Small size (No. 3) screws only are required, but they and the Rawlplugs should be sufficiently long to make a fixing right through to the brickwork.

### Switch Control of Gas Lighting.

Firm fixing of the hand control switch is imperative or it will wobble when turned. Two No. 8 screws are provided and on all walls of brick, concrete, &c., Rawlplugs should be used for these screws.

Too much care cannot be taken to fit the operating cable rigidly between the switch and the lamp. It must be clipped to the wall and/or ceiling as frequently as possible, otherwise "whip" will occur and give poor results. Small Rawlplugs and screws—No. 3—will ensure the cable clips remaining firm.

# Practical Advertising And Salesmanship

by
G. W. ALLEN
(Gas Survey Engineer, Toronto)

From a Paper presented before the Annual Convention of the Canadian Gas Association held at Ottawa on June 10.

Advertising and salesmanship are so closely related in principle that what is essential for the correct application of the science of one is equally applicable to the other.

I here mention "application" for the very reason that all the knowledge we may have of these two business forces is of no use to us unless we have a correct knowledge of how to apply the knowledge in a manner that will bring more business to our establishments. In other words, "Knowledge applied is Power" and not merely "Knowledge is Power."

Thousands of would-be advertising men and near-salesmen have a fairly abundant general knowledge of the profession in which they are respectively engaged, but through an inability to apply the knowledge in a constructive manner, fail to make the impression on the public mind that is so necessary in the making of profitable sales.

At the outset I may say that we of the gas business must early learn to realize that the people generally are not interested in us or our business as such. They care no more for our product, or our appliances, than they do for the moon. What they are interested in is what they can get out of the use of our products. They are only interested in us to the extent of how near we can come to meeting their particular needs. Questions ever in the public mind, if it considers the matter at all, are "What benefits do we receive if we use gas?" "What will it do for us beyond what any other or competing product can do?" "Would it be profitable to us to use gas?" or "Will we obtain greater comfort, convenience, and more satisfactory service if we use gas?" Happy, therefore, is the gas advertising man who can, through means of the printed word, convince the people that "If it is done with heat, it can be done better and cheaper, too, with GAS."

Now, in the matter of lay-out—I mean preparing the advertisement—we should ever keep in mind that the first step towards successful advertising appeal is to lay out our ads. in such a way that favourable attention is attracted to them. Most ads. in general do not attract FAVOURABLE attention. They may attract attention through a form of hieroglyphical-typographical arrangement of type, borders, and illustrations, but it is not the kind of attention we want—in most of such instances it is UNFAVOURABLE attention that is received. The more commonsense we use in our lay-out work, the more practical results will we obtain from our advertising. Most ads. contain far too many different styles and sizes of type, which tend to make them difficult to read, and result in the reader passing them over altogether. Illustrated ads. are by far the most effective, but, even here, the illustrations should be of a character that draw attention to the results of the use of gas, rather than the product itself.

### Placing the Illustration.

The proper placing of illustrations in advertisements is another important consideration. The readers of the newspaper or magazine, whom we are seeking to attract, should not be conscious of the fact that our ads. are ads. only, but that they are in very truth harbingers of blessings capable of being enjoyed by all, and messages of vital import to all who use in any form, whether it be in domestic, commercial, or industrial gas service. We do not want people to say, "Oh, it's only an AD."—we want readers to be so attracted by what we are going to bring to them through the use of gas, and to be so interested in what we illustrate, and what we say in our appeals, that they will be unconscious of the fact that they are simply reading an advertisement after all.

Good illustrations, properly placed, so that the eye of the reader quickly grasps their significance, and is led directly to the vital headline, or opening statements of the proposition, are vitally essential to the success of an advertising appeal.

If what we say in our headline, or title, is not directly of vital importance to the welfare of the reader, no further notice will be taken of the advertisement. It is the same with a salesman—if he is not able or capable of attracting the favourable attention of the person he is approaching, either by his appearance, or what he immediately says by way of introduction, he might as well quit there and then, for all the further headway he hopes to make. Good salesmen dress in modest apparel and usually pay great attention to those things necessary for favourable introductions; so, why advertising men continue to resort to all kinds of forms and shapes, many styles and sizes of type, freakish-looking and hieroglyphically-appearing ad-

# Traffic Vibration

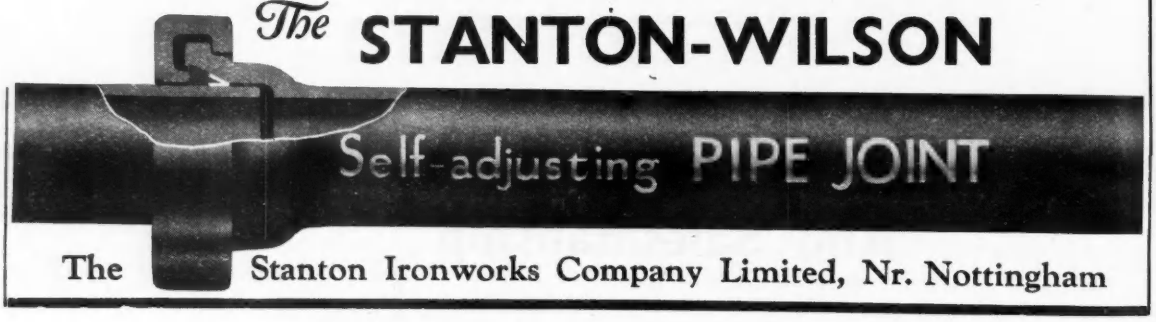
## *Rigid or Self-adjusting Joints?*

**Not many of the problems brought into being by the remarkable growth of road transport during the last decade are capable of easy solution.**

**There is at least one exception, however. For instance, though much has been heard of the danger caused to historic buildings by traffic vibration, the harmful effects of such vibration on water and gas mains are not so apparent. To water and gas engineers responsible, however, for the maintenance of these essential public services, this was a very real problem until a few years ago, for rigidly-jointed mains could not be expected to withstand the severe vibration caused by modern conditions.**

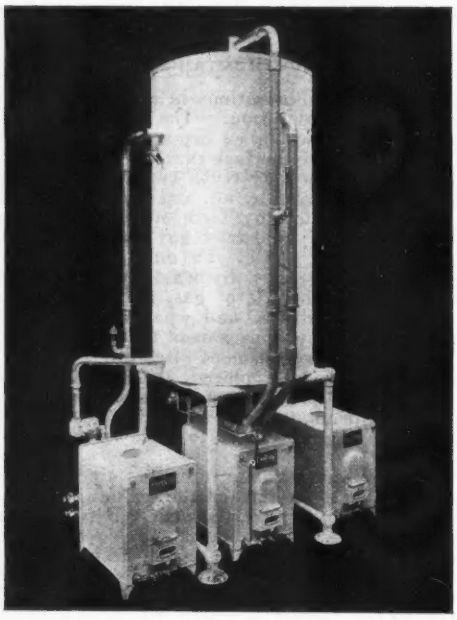
**Some six years ago the Stanton Company introduced the Stanton-Wilson Self-adjusting pipe-joint to overcome this and similar difficulties. That it has successfully done so is proved by the fact that more than 1,500 miles of Stanton-Wilson mains have now been laid by over 750 public authorities.**

*The* **STANTON-WILSON**




**The Stanton Ironworks Company Limited, Nr. Nottingham**

# *Gas-fired Hot Water Apparatus for*



## Culinary Supply and **Dish Washing** in hotels and restaurants

**Fully automatic**
**Clean**
**Simple**
**Reliable**

POTTERTONS' "EMPEROR"

Combination with dual-compartment cylinder delivering Hot Water for general requirements at about 140° F. and scalding water at 185° to 190° F. for Automatic Dish-Washer.

**THOMAS POTTERTON (Heating Engineers) Ltd.**
Telephone : Balham 1244-5-6.
Telegrams : Potterton, Toot, London
**RAVENSWOOD ROAD, BALHAM, LONDON, S.W. 12**

vertisements, in hopes of attracting FAVOURABLE ATTENTION, is more than I can say. I do know that this kind of advertising appeal is what brings about the tremendous wastes going on in the advertising profession throughout the world to-day. Over 80% (if my memory serves me right) of all money spent in advertising, taking it as a whole, is wasted in unprofitable advertising appeals. Surely, in these circumstances, we should do our part to improve the appearance and general efficiency of our advertisements.

Now, as regards salesmanship, I can do no better than say that simply going around hunting prospects for gas or gas appliances, or equipment, is not salesmanship in the true sense of the word. Salesmanship, correctly speaking, is a power within the individual that when rightly applied persuades others to purchase a product at a profit to both the customer and salesman, or as Sheldon says, "To the mutual satisfaction of buyer and seller."

The power or ability within any salesman to get more business is not something natural within him that enables him to sell. Selling is a science, just like any other constructive thing is a science, and it must be learned, if we are rightly to claim the title of being true salesmen. The science of selling embodies a great deal more than simply canvassing for business. True selling implies a preknowledge of a hundred-and-one things that have a bearing on the making of sales, and the real salesman is he who knows what he is doing when he seeks to win trade for his company.

Salesmanship, therefore, embodies the study of prospects long before one meets them. It also includes self-analysis, goods analysis, field or territory analysis, and an ability to analyze the temperament of the various kinds of people we expect to make into customers. The salesman who thinks he is all right and takes no time to gain more real facts and knowledge about himself, his goods, his territory, and his prospects, is on the toboggan slide to oblivion sooner or later, no matter what he thinks to the contrary. Good salesmen never stop growing in knowledge of their business, and their business includes themselves, both mentally and physically. A good salesman studies himself, just as much as he studies the other elements of salesmanship. He should also train himself to visualize where his likely prospects are, and how he should go after them. He studies his goods, and also learns all he can about competing goods. He studies his sales territory so that he can picture all the likely prospects within it, and then begins to apply his knowledge in a manner that enables him to reach his prospects in the shortest possible time, and at least expense on his company. The salesman, so called, who neglects to fit himself at all times for the battle of selling, is not a salesman in the true sense of the word. When I go out selling, I want to know where I am going, whom I am to meet, and how to gain the favourable attention of the prospect when I do meet him. I want to leave my prospects in such a frame of mind that they will be glad to see me when on my next call. Such contacts make for permanent customers.

## Enthusiasm Badly Wanted.

To be a good gas salesman, one should know gas and what its capabilities are in domestic, commercial, and industrial service. People like to do business with salesmen who seem to know their business. We need enthusiastic gas employees badly. Gas Managers can do much to help the cause, if they will themselves enthuse over gas, and see that their employees are taught something about the positive side of the gas business. Such contacts will make them enthusiastic.

If managers are optimistic, so also, in time, will their employees be. They will get the spirit of the thing and begin to work for the business in a way they never worked before. Valuable, enthusiastic, loyal, and industrious employees, especially salesmen, are only the result of favourable contacts with managers, who are themselves intensely interested in the Gas Industry, and who are active in its promotion. If we are showing our own enthusiasm for gas, it will not be long before there will be a noticeable increase in gas sales in our cities.

It is possible to get more business for gas than is being obtained at this present moment by most gas Undertakings, and the only reason it is not being obtained is not because of an apparent high rate for the gas itself, altogether, but because of the few gas men there are who really know GAS, and know how to sell it constructively and scientifically, irrespective of the rate to the public. Gas rates are what they are because of certain local conditions. They cannot always be changed overnight to suit certain sales problems connected with selling, although we all agree that there are certain heating processes that present gas rates would not allow us to obtain.

The question, however, is, do we know that we cannot take on the particular business at present rates? If we have not thoroughly analyzed the specific problem in all its manifold parts, and endeavoured to find out if it is possible to obtain, make, or invent some way of applying the gas that would make it cheap to the user, we have not properly gone about the business of selling gas. Anyone can obtain business that is waiting to be picked up, but it is not everyone who can sell a high-priced gas and, as I said before, make it a cheap fuel to the user of it. It can be done in more instances than is at present the case, but it is only so accomplished by salesmen who know the product from every angle, and have ability enough to apply the knowledge in a business-building manner. The salesman who works on a mistaken notion that he could sell more gas, or gas appliances, if the gas were cheaper, works to his own destruction. I have seen gas salesmen trying to sell gas at ridiculously low rates, and fail to make sales. No one can work efficiently in the gas field if he has a feeling that the gas rate is too high. Outsiders will always say when approached that gas is too costly, and this impression is very apt to weaken a salesman's sales resistance.

Now just a few words on the commercial and industrial salesman and his problem of selling. The principles of selling as applied to other businesses and to other phases of our own business are equally applicable to the industrial gas field. Now an industrial salesman, and it applies to other salesmen, should make every effort to win the favourable attention of every prospect he has the opportunity of interviewing. But, after he has made a favourable approach, it will be strictly up to him to sustain the attention, and to arouse interest in his prospect's mind respecting the proposition he came to present. Many fall down just at this point, because, endeavouring to point out the advantages of gas fuel, they fail to recognize that the prospect knows more about his own individual business than do the salesmen. Favourable attention and interest can only be sustained throughout a selling talk, or interview, when the salesman manifests that he knows what he is talking about, and gains the prospect's confidence through his knowledge of the particular line of business. It is foolish for any salesman to talk about something he knows very little about.

## Industrial Requirements.

When he meets an industrialist, he should show him that he knows somewhat of his requirements in the way of heat application, and can demonstrate to him that his gas Undertaking is willing to show how gas, even at present rates, can be made helpful in the cutting down of the finished cost of any particular product, and add considerably to the quality of the finished product, than is possible with any other fuel, other things being equal. Half the battle of selling lies in how a man approaches his prospect. No matter how good his proposition may be, if the salesman cannot win for himself a favourable appointment and interview, he will never succeed in the field of salesmanship. It is quite possible to develop this happy knack of sales approach if the salesman is willing to sacrifice a little of his time week by week in the study of the things essential and fundamental to all sales activities.

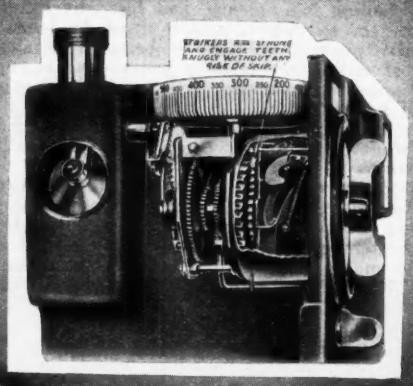
Honesty, health, industry, ability, and knowledge make up the five-fold requirements of the would-be salesman. The cultivation of these makes for increased efficiency. Knowledge of one's business, coupled with a knowledge of how it can be applied to the businesses of others, in a profitable and practical manner, makes for business-building of a satisfactory order. "An enemy known is half beaten" is an old slogan, and could be rendered "A prospect known is half won," from a sales-winning standpoint, and happy again is he who knows, and knows that he knows, all that he is up against when he talks with a prospect for business.

Why gas companies do not demonstrate more what gas can do, even if it means the placing of expensive equipment on a manufacturer's floor, is beyond me. Almost every other business does it, because they know it's a safe bet. If we know that gas will do certain things and do it better than any other fuel, and in many cases cheaper, why, then, should we fear to supply equipment to demonstrate the facts?

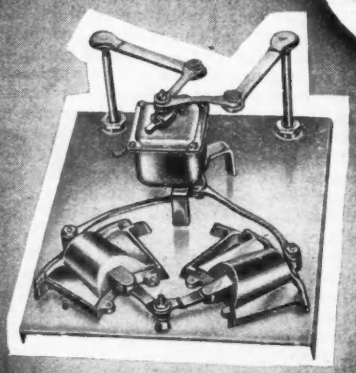
In closing let me say that more business does exist for gas utilities willing to go after it in the right way, and in the right spirit. There are hundreds and thousands of factory managers willing to listen to the intelligent salesman who can show how the ultimate costs of a manufactured product can be reduced by the use of gas.

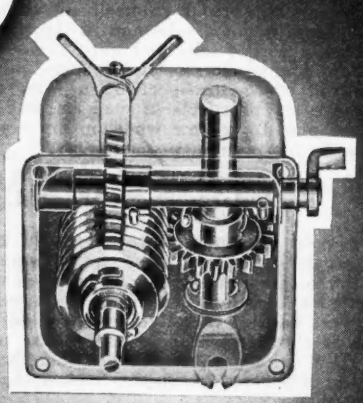
The fear to allow prospects to try a product for themselves has ruined many an otherwise promising business, and most successful businesses to-day have been built on the policy of "Try before you buy." Why not let it be the gas business?

# SMITH METERS LTD



THE COMBINATION WHICH HAS WITHSTOOD THE TEST OF TIME





Head Office and Works :

**186, KENNINGTON PARK RD., LONDON, S.E. 11**

Telephones : RELIANCE 2447-8-9. POLLARDS 2371-2-3, 3184, 4000.
Telegrams : SMIETERS, LAMB, LONDON.

3-4, EAST PARADE, LEEDS, 1
Telephone : LEEDS, 23726

Australian Agents : GAS METERS, LTD. SYDNEY

# New Season's Lists

### Cannon's "Virginia" Self-Lighting Fire.

A particularly attractive model in the new season's list of Cannon Iron Foundries, Ltd., is the "Virginia" fire which incorporates automatic ignition; the control being on the canopy, any undue stooping when lighting the fire is obviated. The "Virginia" can be had with five, seven, nine, or eleven radiants.

The makers state that the introduction of the inclined gas fire marked a great advance in gas fire design. By inclining the radiants some of the heat formerly wasted on the hearth was added to the amount radiated horizontally and upwards. At an angle of 20° the radiants give out the best possible distribution in a vertical direction. The V-Inclined is an improvement upon the earlier inclined fires. Not only is the "up and down" heat correctly distributed, but the "side to side" distribution is similarly improved. The inclined radiants are stepped from the centre radiant, with the result that far more heat is radiated sideways, it is claimed, than in the case of a flat-fronted fire.

It is also claimed the amount of heat radiated from an inclined fire is greater. Long research into the properties of insulating materials has enabled the firm to make a radiant and fire-back which are highly efficient. These factors render the V-Inclined an extremely economical fire.

Other handsome models described in the list include the "Veronica," the "Verbena," and the "Viola," all of which are fitted with automatic ignition.

### "Sugg" Lamps and Fittings.

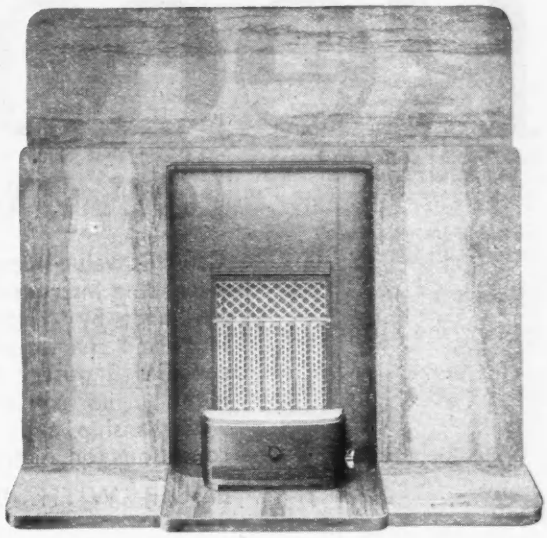
Lamps and fittings for interior and exterior lighting of shops, factories, offices, institutions, and the home are to be found in the recently issued list of Messrs. William Sugg & Co., Ltd., Ranelagh Works, Chapter Street, Westminster, S.W. 1.

The opening pages of the list are devoted to the various forms of the firm's patent distant control device which has done so much during the past several years to give gas lighting the wonderful ease of operation it possesses to-day. The device can be applied to most of the fittings listed, and the firm can also supply and fit, if desired, the "Newbridge" positive or catalytic devices (including "Comet" ignition) or pneumatic switch control. The fashionable trend towards metal shop fronts and interior fittings in chromium plate and other finishes designed to conform with prevailing architecture have called forth lighting fittings which are in keeping with the general scheme. The "Rochester" or "Littleton" lamp in chromium plate with white octagonal panelled glassware, the "Arcade" fitting and the "Streatham," "Salon," and "Bon Marché" meet this demand completely and also provide a means of imparting the touch of modernity to older premises.

A system of ventilating lights is fully explained in the catalogue; this enables adequate ventilation to be obtained without any draught. The other fittings are too varied and numerous to permit of a detailed description of each, but many handsome lamps such as the "Braeside," a tasteful pendant for domestic, showroom, or office lighting, and the "Kenavon" and "Elmside" pendants which are in accord with modern architecture, call for particular mention.

### John Wright's "Symphonie" High Beam.

An interesting gas fire design and one calling for special attention as departing from common practice is the "Symphonie" High Beam hearth type fire. The usual canopy is done away with and the whole of the heating unit is contained within the fire front, thus greatly simplifying fitting.



The "Symphonie" is one of the new designs illustrated by Messrs. John Wright & Co., Ltd., in their new High Beam fire list.

# Further Gas Undertakings' Results

### Atherton.

The annual report submitted to the Atherton (Lancs.) Council by Mr. W. T. Duxbury, Gas and Water Engineer, states there was a gross profit of £2,901, which after deducting interest and sinking fund charges leaves a net profit of £1,306. The total income for the year shows an increase on last year of £887. On the other hand, the total expenditure has been decreased by £125 on the previous year. The principal item of expenditure was on coal, when £5,780 was spent in 1937, compared with £5,260 in 1936. The quantity of gas produced reached a record high figure of 85,505,100 cu.ft., an increase of over 2 million cu.ft. on the previous year. There was an increase of 3,049,252 cu.ft. of gas sold during the year.

### Morpeth.

The Directors of the Morpeth Gas Light Company (1902), Ltd., report that for the year ended June 30, 1937, the gross profit amounts to £3,846, which, with £1,867 brought forward from last year, gives a total of £5,713 available. The Directors recommend that this be dealt with as follows: In writing off for depreciation on meters and cookers, £620; in placing to general reserve account, £600; in placing to reserve for special renewals of plant, &c., £200; in provision for showroom alterations, £500; income-tax, £526; in paying 6% for the year on preference shares, less income-tax, £636 (of this, an interim dividend amounting to £320, being at the rate of 3% less tax, was paid in February last); in paying 6% for the year on ordinary shares, less income-tax, £768 (of this, an interim dividend amounting to £323, being at the rate of 2½% less tax, was paid in February last); and in carrying forward a balance of undivided profits of £1,863. There was an increase of almost 2 million cu.ft. in the output of gas, the total amount constituting a record for the Company. Premises in the main thoroughfare have been secured for showrooms. A new public lighting contract for five years was entered into in the autumn of last year.

### Newhaven.

The Directors of the Newhaven Gas and Coke Company in their annual report for the year ended June 30, 1937, state that there has been an increase in the sale of gas of 32%. During the year there were issued 2,143 additional ordinary shares of £1 each, the net amount received being £3,764, and a sum of £1,891 was received from an issue of 75 4¼% redeemable debentures of £25 each. The credit balance for the year was £2,995, from which the Directors recommend a final dividend of 4¼%, less tax, on the original and additional ordinary shares, making 8½% for the year. A dividend of 2⅛%, less tax, has been declared on the new additional ordinary shares in respect of the quarter to June 30.

### Warrington.

The Warrington Gas Undertaking reports a profit of £3,789 on the year's operations. This is an increase of £690 on the previous year. The income from the sale of gas, residuals, and the income from the rent and sales of cooking ranges showed an increase of £12,268 on the previous year, but working expenses were up £11,577.

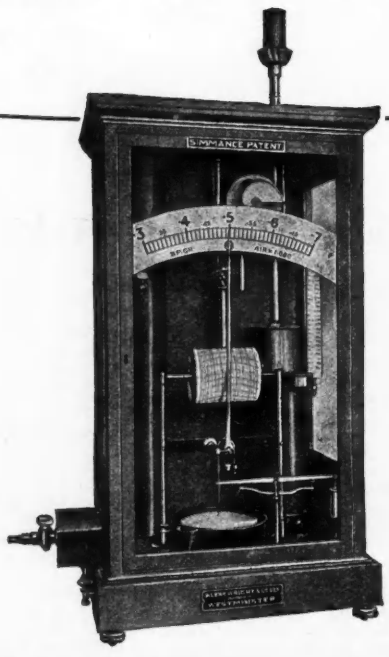
10/10 They always make full marks

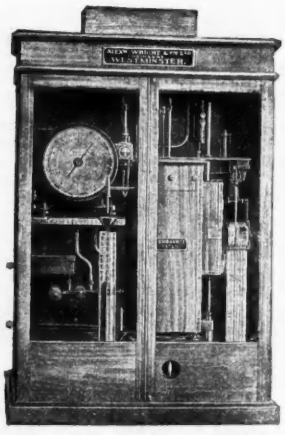
# Recorders

## for every requirement

Calorific value—Specific gravity—Pressure and Vacuum. Recording instruments for all of these dominant factors are made by Wright's, the people who have the knowledge and the experience arising from close contact with the Gas Industry for nearly a century. An instrument *made by Wright's* is a guarantee of sound workmanship and satisfactory service under gasworks conditions for a long term of years.

EQUIP WITH INSTRUMENTS BY WRIGHT'S





Alexander Wright & Co. Ltd.
WESTMINSTER · S · W · 1

# Gas Markets and Manufactures

## Stock Market Report

**(For Stock and Share Lists, see later pages)**

Markets last week continued to be influenced by disturbances abroad and the general tendency was quiet. Events in the Far East and the Mediterranean still cause anxiety, and it is rather surprising, though a tribute to the strength of home affairs, that prices have not dropped to lower levels. Investors, however, are keeping their heads, and in the absence of any panicky liquidation values generally are being well maintained. British Funds were firm until the close, when a few extra selling orders led to some irregularity. Dealings in the industrial section were again on a small scale, though the general tone was somewhat firmer and price changes moved within narrow limits. Oil and rubber shares were inclined to harden, but a subsequent fall in the spot price of the latter commodity quickly brought down values to their former levels.

The volume of business in the gas section was again small and only forced sales appear to be coming into the market. Prices generally remained firm with here and there some upward movements, though, as elsewhere, the market was not devoid of a few set-backs. Bournemouth 5% was moved up 5½ points to 202½ and Colonial preference improved 6d. to 23s. 6d. On the other hand, a sharp drop of 7 points occurred in North Middlesex 6%, and South Metropolitan ordinary eased towards the close. At the Provincial Exchanges Sheffield Consolidated moved up 1 point, but Newcastle and Gateshead Consolidated dropped 1s., due mainly to the narrowing of the margin.

The Directors of the South-Eastern Gas Corporation have declared an interim dividend of 3% for the half-year to Sept. 30, the same as a year ago. For the year 1936-37 a dividend of 6% was paid, and on this basis at the present price the shares give a yield of about 4%. The Corporation has recently made an offer to acquire the shares of the Windsor Royal Gas Light Company, particulars of which appeared in last week's issue.

## Current Sales of Gas Products

### The London Market for Tar Products.

LONDON, *Sept.* 6.

Prices of tar products in general remain unchanged as follows:

Pitch, 38s. per ton f.o.b.

Creosote, 6d. to 6¼d.

Refined tar, 3¾d.

Pure toluole, 2s. 5d. to 2s. 6d.; pure benzole, 1s. 9d.; 95/160 solvent naphtha, 1s. 8d.; and 90/160 pyridine, about 10s.; all per gallon naked at makers' works.

### Tar Products in the Provinces.

*Sept.* 6.

The average prices of gas-works products during the week were: Gas-works tar, 23s. 6d. to 28s. 6d. Pitch—East Coast, 36s. to 37s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 36s. to 37s. 6d.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal tar, crude naphtha, in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4⅝d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 4s. 1½d. to 4s. 3d. Naphthalene, £18 to £20. Salts, 90s. to 95s., bags included. Anthracene "A" quality, 4½d. to 4⅝d. per minimum 40% purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

### Tar Products in Scotland.

GLASGOW, *Sept.* 4.

There are, if anything, more enquiries, but new business continues rather difficult.

Crude gas-works tar.—Actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch is not attracting much attention, although makers are maintaining prices at round 30s. to 32s. 6d. per ton f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar.—New business is on a small scale, with values steady at 3d. to 3½d. per gallon free on rails for export, and 3½d. to 3¾d. per gallon *ex* works in buyers' packages for home trade.

Creosote oil.—Supplies are not at all plentiful and quotations are not lower than the following: Specification oil, 5½d. to 5¾d. per gallon; low gravity, 6d. to 6¼d. per gallon; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—There is practically no new business being placed, and to-day's actual values can be taken as follows: Pale, 97/99%, 4s. 1d. to 4s. 4d. per gallon; dark, 97/99%, 3s. 10d. to 4s. per gallon; and pale, 99/100%, 4s. 6d. to 4s. 9d. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—There is a steady demand for available supplies at round 6d. to 6½d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 5d. to 1s. 6d. per gallon, and 90/190 heavy naphtha, 1s. to 1s. 1d. per gallon.

Motor benzole continues steady at about 1s. 4½d. to 1s. 5d. per gallon.

Pyridine.—While supplies are limited actual values are now 8s. to 9s. per gallon for 90/160 grade, and 9s. to 10s. per gallon for 90/140 grade.

### Benzole Prices.

These are considered to be the market prices for benzole at the present time:

| | s. | d. | | s. | d. | | | |
|---|---|---|---|---|---|---|---|---|
| Crude benzole . . . | 0 | 9½ | to | 0 | 10 | per gallon | at | works |
| Motor ,, . . . | 1 | 3 | ,, | 1 | 3½ | ,, | ,, | ,, |
| 90% ,, . . . | 1 | 4 | ,, | 1 | 4½ | ,, | ,, | ,, |
| Pure ,, . . . | 1 | 8 | ,, | 1 | 8½ | ,, | ,, | ,, |

## Trade Notes

### Distinctive Colours for Pipe Lines.

In our account (July 28 issue) of the reconstructed Gas-Works at Ilkeston we mentioned that the whole of the various gas, liquor, tar, water, steam, and condensate piping had been painted in distinctive colours, and the inlet, outlet, and by-pass valves of all the apparatus also picked out with a distinctive colour.

The colours for this work were supplied by Messrs. Donald Macpherson & Co., Ltd., who inform us that for a considerable time they have made a range of very durable enamels in bright colours, specially prepared to resist gas-works conditions. Examples of these are bright yellow for steam, bright green for gas, black for tar, flame colour for electricity, &c. For a number of gas undertakings they have prepared for display at different points on the works charts showing the actual colours so that the staff can tell at a glance what any particular pipe line is.

**NEW VERTICAL RETORT PLANTS NOW IN REGULAR SERVICE**

This installation, built for the Municipality of Svendborg, Denmark, is an interesting example of the modern Glover-West vertical retort plant designed for the smaller works. It is an eight-retort unit with fuel-gas producers equipped for breeze-burning, waste-heat recovery plant and electric lift. Coaling is by means of an automatic skip-hoist.

**400 plants in 24 countries**

THE SOCIETY OF BRITISH GAS INDUSTRIES · 1905 ·

**WEST'S GAS IMPROVEMENT CO., LTD.**

**MANCHESTER:** ALBION IRONWORKS, MILES PLATTING ■ **LONDON:** COLUMBIA HOUSE, ALDWYCH, W.C. 2

# STOCK AND SHARE LIST

## Official Quotations on the London Stock Exchange

| Issue. £ | Stock or Share | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations Sept. 3 | Rise or Fall on Week. | Transactions. Lowest and Highest Prices During the Week. |
|---|---|---|---|---|---|---|---|---|
| 1,767,439 | Stk. | Mar. 15 | 8 | 8 | Alliance & Dublin Ord. ... | 170—175 | ... | ... |
| 374,000 | ,, | June 21 | 4 | 4 | Do. 4 p.c. Deb. ... | 95—100 | ... | ... |
| 558,890 | ,, | Aug. 9 | 7 | 7 | Barnet Ord. 7 p.c. ... ... | 158—163 | ... | 162—162½ |
| 300,000 | 1 | Apl. 5 | 1/9⅛ | 1/9⅛ | Bombay, Ltd. ... ... ... | 26/6—28/6 | ... | ... |
| 179,915 | Stk. | Aug. 9 | 9½ | 9½ | Bournemouth sliding scale ... | 200—205 | + 5½ | 203½—205 |
| 590,407 | ,, | ,, | 7 | 7 | Do. 7 p.c. max. ... | 158—163 | ... | ... |
| 493,950 | ,, | ,, | 6 | 6 | Do. 6 p.c. Pref ... | 130—135 | ... | 133—134 |
| 50,000 | ,, | June 21 | 3 | 3 | Do. 3 p.c. Deb. ... | 79—84 | ... | 82 |
| 262,025 | ,, | ,, | 4 | 4 | Do. 4 p.c. Deb. ... | 98—103 | ... | ... |
| 335,000 | ,, | ,, | 5 | 5 | Do. 5 p.c. Deb. ... | 116—121 | ... | ... |
| 357,900 | ,, | Aug. 9 | 7½ | 7½ | Brighton, &c., 6 p.c. Con. ... | 152—157 | ... | 154 |
| 649,955 | ,, | ,, | 6½ | 6½ | Do. 5 p.c. Con. ... | 135—140 | ... | 139½ |
| 205,500 | ,, | ,, | 6 | 6 | Do. 6 p.c. 'B' Pref. | 127—133 | ... | ... |
| 855,000 | ,, | Mar. 1 | 7 | 8 | British Ord. ... ... ... | 148—153 | ... | 150 |
| 100,000 | ,, | June 21 | 7 | 7 | Do. 7 p.c. Pref. ... ... | 140—145 | ... | ... |
| 350,000 | ,, | ,, | 5½ | 5½ | Do. 5½ p.c. 'B' Cum. Pref. | 108—113 | ... | ... |
| 120,000 | ,, | June 7 | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 95—100 | ... | ... |
| 450,000 | ,, | ,, | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 102—107 | ... | ... |
| 450,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 95—100 | ... | ... |
| 100,000 | 10 | 22 May '33 | 6 | 4 | Cape Town, Ltd. ... ... | 1⅛—2⅛ | ... | ... |
| 100,000 | 10 | 6 Nov.'33 | 4½ | 4½ | Do. 4½ p.c. Pref. ... | 1⅛—3⅛ | ... | ... |
| 150,000 | Stk. | June 21 | 4½ | 4½ | Do. 4½ p.c. Deb. ... | 79—84 | ... | ... |
| 626,860 | ,, | July 19 | 6 | 6 | Cardiff Con. Ord. ... ... | 125—130 | ... | ... |
| 237,860 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Red. Deb. | 107—112 | ... | ... |
| 98,936 | 1 | Apl. 5 | 2/- | 2/- | Colombo Ord. ... ... | 1⅞—1⅞ | ... | ... |
| 24,510 | 1 | ,, | 1/4½ | 1/4½ | Do. 7 p.c. Pref. ... | 23/—25/- | ... | ... |
| 739,453 | 1 | Mar. 15 | -/11·48 | -/11·48 | Colonial Gas Assn. Ltd. Ord. | 18/—20/- | ... | 18/3 |
| 296,144 | 1 | ,, | 1/3·30 | 1/3·30 | Do. 8 p.c. Pref | 22/6—24/6 | + -/6 | 23/9 |
| 1,775,005 | Stk. | Aug. 9 | 5 | 5 | Commercial Ord. ... ... | 90—95 | ... | ... |
| 620,000 | ,, | June 7 | 3 | 3 | Do. 3 p.c. Deb. ... | 74—79 | ... | ... |
| 286,344 | ,, | Aug. 23 | 5 | 5 | Do. 5 p.c. Deb. ... | 113—118* | ... | ... |
| 807,560 | ,, | Aug. 9 | 7 | 7 | Croydon sliding scale ... | 140—145 | ... | 143½ |
| 644,590 | ,, | ,, | 5 | 5 | Do. max. div. ... ... | 108—113 | ... | 111—112 |
| 620,385 | ,, | June 21 | 5 | 5 | Do. 5 p.c. Deb.... ... | 113—118 | ... | ... |
| 239,000 | ,, | Aug. 9 | 5 | 5 | East Hull Ord. 5 p.c.... ... | 98—103 | ... | ... |
| 185,355 | ,, | Aug. 9 | 6 | 6 | East Surrey Ord. 5 p.c. ... | 120—125 | ... | ... |
| 176,211 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Deb. ... | 113—118 | ... | ... |
| 250,000 | 1 | July 5 | 4 | 7 | Gas Consolidation Ord. ... | 20/—22/- | ... | ... |
| 250,000 | 1 | May 24 | 4 | 4 | Do. 4 p.c. Red Cum. Pref. | 19/—21/- | ... | 19/6 |
| 19,255,284 | Stk. | Aug. 9 | 5½ | 5½ | Gas Light & Coke 4 p.c. Ord. | 24 3—25/3a | ... | 24 6—25/- |
| 2,600,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. max. ... ... | 82—85 | ... | 84½ |
| 4,477,106 | ,, | ,, | 4 | 4 | Do. 4 p.c. Con. Pref. ... | 99—102 | ... | 101 |
| 2,993,000 | ,, | July 5 | ... | 3½ | Do 3½ p.c. Red. Pref. | 100—103 | ... | 102½—102½ |
| 8,602,497 | ,, | May 24 | 3 | 3 | Do. 3 p.c. Con. Deb. ... | 76—79 | — 1 | 76¾—78¼ |
| 3,642,770 | ,, | ,, | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 111—114 | ... | 112¾ |
| 3,500,000 | ,, | ,, | 4½ | 4½ | Do. 4½ p.c. Red. Deb.... | 110—113 | ... | ... |
| 700,000 | ,, | Mar. 1 | §25/5 | 3½ | Do. 3½ p.c. Red. Deb.... | 95—100 | ... | 97—97½ |
| 270,466 | ,, | Aug. 23 | 6 | 6 | Harrogate New Cons. ... | 120—125* | ... | ... |
| 213,200 | ,, | Aug. 9 | 6 | 6 | Hornsey Con. 3½ p.c. ... | 118—123 | ... | 119½—120½ |
| 5,600,000 | ,, | May 24 | 8 | 12 | Imperial Continental Cap. ... | 143—148 | ... | 144½—147 |
| 223,130 | ,, | July 19 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 89—94 | ... | 92½—93 |
| 285,242 | ,, | Aug. 9 | 8½ | 8½ | Lea Bridge 5 p.c. Ord. ... | 158—163 | ... | ... |
| 75,000 | ,, | May 24 | †10 | †10 | Malta & Mediterranean ... | 150—160 | ... | ... |
| 392,000 | — | Apl. 1 | 5½ | 5½ | Metropolitan (of Melbourne) 5½ p.c. Red. Deb. ... ... | 98—103 | ... | ... |
| 231,978 | Stk. | Aug. 23 | 5 | 5 | M.S. Utility 'C' Cons. ... | 101—106* | ... | ... |
| 968,657 | ,, | ,, | 4 | 4 | Do. 4 p.c. Cons. Pref. | 96—101* | ... | ... |
| 360,075 | ,, | June 21 | 4 | 4 | Do. 4 p.c. Deb. ... | 97—102 | ... | ... |
| 148,955 | ,, | ,, | 5 | | Do. 5 p.c. Deb. ... | 115—120 | ... | ... |
| 125,000 | — | July 1 | 3½ | 3½ | Do. 3½ p.c. Rd.Rg.Bds. | 96—99 | ... | ... |
| 675,000 | Stk. | May 3 | †6 | †9 | Montevideo, Ltd. ... ... | 89—94 | ... | 91 |
| 250,000 | ,, | Aug. 9 | 7½ | 7½ | North Middlesex 6 p.c. Con. | 150—160 | —7 | ... |
| 396,160 | ,, | Aug. 9 | 5 | 5 | Northampton 5 p.c. max. ... | 110—115 | ... | ... |
| 300,000 | ,, | Apl. 19 | †9 | †7 | Oriental, Ltd.... ... ... | 162—167 | ... | ... |
| 468,537 | ,, | June 7 | 8 | 8 | Plymouth & Stonehouse 5 p.c. | 160—170 | ... | 161 |
| 621,667 | ,, | Aug. 9 | 8½ | 8½ | Portsmouth & Gosport Cons. | 164—169 | ... | ... |
| 241,446 | ,, | ,, | 5 | 5 | Do. 5 p.c. max. ... | 104—109 | ... | ... |
| 73,350 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 110—115 | ... | ... |
| 441,275 | 1 | May 3 | 1/- | 1/1½ | Severn Val. Gas Cor. Ld. Ord. | 21/—23/- | ... | ... |
| 460,810 | 1 | Mar. 15 | -/10½ | -/10½ | ,, ,, 4½ p.c. Cum. Pref. | 20/—22/- | ... | ... |
| 133,201 | Stk. | Aug. 23 | 5 | 8½ | Shrewsbury 5 p.c. Ord. ... | 130—135* | ... | ... |
| 1,371,752 | 1 | May 3 | 1/2⅝ | 1/2⅝ | South East'n Gas. Cn.Ld. Ord. | 24'—26'- | ... | 24 9 |
| 871,636 | 1 | Mar. 1 | -/10⅝ | -/11⅛ | Do. 4½ p.c. Red. Cum. Pref. | 20/—22/- | ... | 20/6—21/6 |
| 498,818 | 1 | ,, | 4 | 4 | Do. 4 p.c. Cum. Pref. ... | 18'6—20/6 | ... | 19/6 |
| 450,000 | Stk. | Aug 9 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 99—102 | ... | ... |
| 150,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 98—100 | ... | ... |
| 6,709,895 | ,, | Aug. 9 | 6 | 5 | South Met. Ord. ... ... | 104—107 | — 1 | 104½—105½ |
| 1,135,812 | ,, | ,, | 6 | 6 | Do. 6 p.c Irred. Pf. ... | 130—135 | ... | ... |
| 850,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Irred. Pf. ... | 98—101 | ... | 99—100 |
| 1,895,445 | ,, | June 21 | 3 | 3 | Do. 3 p.c. Deb. ... | 75—80 | ... | ... |
| 1,000,000 | ,, | July 5 | 5 | 5 | Do. 5 p.c. Red. Deb.... | 110—113 | ... | ... |
| 1,543,795 | ,, | Aug. 9 | 6 | 6 | South Suburban Ord. 5 p.c.... | 120—125 | .. | 122½—123 |
| 512,825 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref ... | 110—115 | ... | 113—114 |
| 500,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref.... | 95—100 | ... | 98 |
| 250,000 | ,, | ,, | ... | §18/9 | Do. 3½ p.c. Red. Pref. | 98—101 | ... | ... |
| 888,587 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Deb.... | 115—120 | ... | ... |
| 250,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Deb.... | 97—102 | ... | ... |
| 200,000 | ,, | ... | ... | ... | Do. 3½ p.c. Red. Deb. | 95—100 | ... | ... |
| 427,859 | 1 | May 3 | 9⅜ | 1/2⅜ | S. Western Gas & Water Ord. | 19/—21/- | ... | ... |
| 160,523 | 1 | Apl. 19 | -/10⅜ | -/10⅜ | Do. 4½ p.c. Red. Cum. Pf. | 20/—22/- | ... | ... |
| 110,000 | Stk. | June 21 | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 97—102 | ... | ... |
| 750,541 | ,, | Aug. 9 | 5½ | 5 | Southampton Ord. 5 p.c. ... | 111—116 | ... | ... |
| 148,836 | ,, | June 7 | 4 | 4 | Do. 4 p.c. Deb. | 97—102 | ... | ... |
| 350,000 | ,, | Aug. 23 | 5½ | 5½ | Swansea 5½ p.c. Red. Pref. ... | 110—115* | ... | 112 |
| 94,000 | ,, | June 7 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 95—100 | ... | ... |
| 1,076,490 | ,, | Aug. 9 | 6⅜ | 6⅜ | Tottenham and District Ord. | 135—140 | ... | 136—139 |
| 409,835 | ,, | ,, | 5½ | 5½ | Do. 5½ p.c. Pref.... | 121—126 | ... | 123—125 |
| 62,235 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 110—115 | ... | 114 |
| 371,850 | ,, | June 7 | 4 | 4 | Do. 4 p.c. Deb. ... | 97—102 | ... | ... |
| 750,000 | 1 | Apl. 5 | 4 | 6 | U. Kingdom Gas Cor. Ord. | 20/—22/- | ... | 20/—21/- |
| 936,338 | 1 | May 3 | 4½ | 4½ | Do. 4½ p.c. Ist Cum. Pref. | 20/—22/- | ... | 20/10½—21/3 |
| 740,933 | 1 | June 7 | 4½ | 4½ | Do. 4½ p.c.2nd Non-Cum.Pf | 17/—19'- | ... | 18/4½ |
| 700,000 | Stk. | Mar. 15 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 96—99 | ... | 97¾ |
| 373,939 | ,, | Aug. 9 | 7 | 7 | Uxbridge, &c., 5 p.c. ... | 147—152 | ... | ... |
| 133,010 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 109—114 | ... | ... |
| 1,371,138 | ,, | Aug. 9 | 7 | 7 | Wandsworth Consolidated ... | 141—146 | ... | 142—142½ |
| 1,620,615 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 117—122 | ... | ... |
| 500,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. ... | 97—100 | ... | 99 |
| 1,343,964 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Deb. ... | 115—120 | ... | ... |
| 383,745 | ,, | ,, | 4 | 4 | Do. 4 p.c. Deb. ... | 97—102 | ... | ... |
| 558,342 | ,, | Aug 9 | 7 | 7 | Watford and St. Albans Ord. | 140—145 | ... | 143—143½ |
| 200,000 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 109—114 | ... | ... |
| 200,000 | ,, | ,, | 5½ | 5½ | Do. 5½ p.c. Pref. ... | 121—126 | ... | ... |
| 200,000 | ,, | June 7 | 4 | 4 | Do. 4 p.c. Red. Deb. | 97—102 | ... | ... |
| 100,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. Red.Deb. | 95—100 | ... | ... |

a.—The quotation is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year. § Actual.

**Stock and Share List continued overleaf.**

**Electricity on Gas Works**

by H. C. Widlake, A.I.E.E., Assoc. M.Inst.Gas E.

Students in Gas Engineering should note that the remaining copies of this book are still on offer at

**Half Price**

186 pp. Demy 8vo.
Fully illustrated
Bound in red cloth

**10/6**

WALTER KING, LTD.
"Gas Journal" Offices
11, Bolt Court, Fleet St., London, E.C. 4

# STOCK AND SHARE LIST—Cont.

## Stocks Officially Quoted on Provincial Exchanges

| Issue. £ | Stock or Share | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations. Sept. 3. | Rise or Fall on Week. | Transactions, Lowest and Highest During the Week. |
|---|---|---|---|---|---|---|---|---|
| **BRISTOL EXCHANGE.** | | | | | | | | |
| 347,756 | Stk. | July 19 | 6 | 5 | Bath Cons. ... ... ... | 119—121 | ... | ... |
| 1,667,250 | ,, | July 19 | 5 | 5 | Bristol, 5 p.c. max. ... ... | 117—118 | ... | ... |
| 120,420 | ,, | June 7 | 4 | 4 | Do. 1st 4 p.c. Deb. ... | 100½—102½ | ... | ... |
| 217,870 | ,, | ,, | 4 | 4 | Do. 2nd 4 p.c. Deb. ... | 100½—102½ | ... | ... |
| 328,790 | ,, | ,, | 5 | 5 | Do. 5 p.c. Deb. ... ... | 120—123 | ... | ... |
| 274,000 | ,, | July 19 | 5 | 5 | Newport (Mon.) 5 p.c.max. ... | 101—106 | ... | ... |
| 13,200 | 12 | Mar. 15 | 7 | 8 | Pontyp'l Gas & W. 10 p.c. 'A' | 13½—14½ | ... | ... |
| 13,600 | 10 | ,, | 5 | 6 | Do. 7 p.c. 'B' | 12—12½ | ... | ... |
| 40,000 | 10 | ,, | 5 | 6 | Do. 7 p.c. 'C' | 12—12½ | ... | ... |
| 140,778 | Stk. | Aug. 9 | 5 | 5 | Weston-super-Mare Cons. ... | 110—112 | ... | ... |
| 64,338 | ,, | June 21 | 4 | 4 | Do. 4 p.c. Deb. | 96—98 | ... | ... |
| 33,340 | ,, | ,, | 7½ | 7½ | Do. 7½ p.c. Deb. | 157—160 | ... | ... |
| **LIVERPOOL EXCHANGE.** | | | | | | | | |
| 157,150 | Stk. | Aug. 9 | 6½ | 5 | Chester 5 p.c. Ord. ... ... | 104—109 | ... | ... |
| 92,500 | ,, | June 21 | 4 | 4 | Do. 4 p.c. Pref. ... ... | 97—101 | ... | ... |
| 36,430 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. Deb.... | 89—92 | ... | ... |
| 41,890 | ,, | ,, | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 98—102 | ... | ... |
| 2,167,410 | ,, | Aug. 23 | 6 | 6 | Liverpool 5 p.c. Ord. ... | 124½—126½* | ... | 126 |
| 245,500 | ,, | June 21 | 5 | 5 | Do. 5 p.c. Red. Pref. ... | 99—104 | ... | 103½ |
| 306,083 | ,, | July 1 | 4 | 4 | Do. 4 p.c. Deb. ... | 102—104 | ... | ... |
| 106,280 | ,, | Aug. 9 | 10 | 10 | Preston 'A' 10 p.c. ... ... | 206—216 | ... | ... |
| 188,219 | ,, | ,, | 7 | 7 | Do. 'B' 7 p.c. ... ... | 147—157 | ... | ... |
| **NEWCASTLE EXCHANGE.** | | | | | | | | |
| 122,577 | Stk. | Aug. 9 | 8 | 8 | Blyth 5 p.c. Ord. ... ... | 165—166 | ... | ... |
| 732,000 | ,, | Feb. 15 | 5 | 5 | Hartlepool G. & W. Cn. & New | 122—123 | .. | ... |
| 2,061,315 | ,, | Aug. 9 | 5¾ | 5 | Newcastle & Gateshead Con. | 23/9—24/3a | - 1/- | ... |
| 682,856 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. ... | 97—99 | ... | ... |
| 776,706 | ,, | June 21 | 3½ | 3½ | Do. 3½ p.c. Deb. ... | 91—92 | ... | ... |
| 277,285 | ,, | Nov. 2 | 5 | 5 | Do. 5 p.c. Deb. '43... | 108—109 | ... | ... |
| 332,351 | ,, | Aug. 23 | 6 | 6 | Sunderland 6 p.c. max. ... | 139—141* | ... | ... |
| **NOTTINGHAM EXCHANGE.** | | | | | | | | |
| 542,270 | Stk. | Aug. 9 | 9 | 6 | Derby Con. ... ... ... | 150—160 | ... | ... |
| 55,000 | ,, | June 7 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 100—105 | ... | ... |
| 84,750 | ,, | Feb. 17 | 5 | 12 | Long Eaton 'A' Ord. ... | ... | ... | ... |
| 50,000 | ,, | ,, | 4 | 10 | Do. 'B' Ord. ... | ... | ... | ... |
| 20,000 | 10 | June 21 | 5 | 5 | Do. 5 p.c. Pref. ... | 10—12 | ... | ... |
| 80,000 | Stk. | ,, | 5 | 5 | Do. 5 p.c. Deb. ... | 105—110 | ... | ... |
| **SHEFFIELD EXCHANGE.** | | | | | | | | |
| 10,000 | Stk. | Feb. 15 | 10 | 10 | Great Grimsby 'A' Ord. ... | 210—220 | ... | ... |
| 6,500 | ,, | ,, | 10 | 10 | Do. 'B' Ord. ... | 210—220 | ... | ... |
| 79,000 | ,, | ,, | 10 | 10 | Do. 'C' Ord. ... | 205—210 | ... | ... |
| 1,806,339 | ,, | Aug. 23 | 6 | 6½ | Sheffield Cons. ... ... | 145—149 | +1 | 147½ |
| 95,000 | ,, | July 5 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 100—103 | ... | ... |

## Supplementary List of Stocks and Shares not Officially Quoted

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 202,152 | Stk. | Mar. 15 | 25/-b | 25/-b | Ascot Ord. ... ... ... | 102—107 | ... | ... |
| 128,182 | ,, | July 5 | 5 | 5 | Do. 5 p.c. Pref. ... ... | 108—113 | ... | ... |
| 573,156 | 1 | May 24 | 5 | 5 | Assd. Gas and Water Ord. ... | 19/6—21/6 | ... | 19/6 |
| 500,000 | 1 | ,, | 4½ | 4½ | Do. 4½ p.c. Red. Cum. Pref. | 19/6—21/6 | ... | ... |
| 500,000 | Stk. | Mar. 15 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 95—100 | ... | ... |
| 31,035 | 1 | Aug. 23 | ... | -/4½ | Associated Utilities 4 p.c. Pref. | 17/—19/-* | ... | ... |
| 100,000 | Stk. | ... | ... | ... | Do. 3½ p.c. Red. Deb. | 95—100 | ... | ... |
| 17,000 | ,, | Aug. 23 | 8 | 8 | Bognor Orig. Ord. 'A' ... | 160—170* | ... | ... |
| 62,210 | ,, | ,, | 8 | 8 | Do. New Addl. 'A' ... | 160—170* | ... | ... |
| 87,160 | ,, | ,, | 7 | 7 | Do. New 7 p.c. max. ... | 141—146* | ... | ... |
| 37,440 | ,, | Aug. 9 | 10 | 10 | Cam. Univ. & Town 10 p.c.max. | 193—203 | ... | ... |
| 125,970 | ,, | ,, | 7 | 7 | Do. 7 p.c. max. ... ... | 135—140 | ... | ... |
| 39,025 | ,, | ,, | 5 | 5 | Do. 5 p.c. max. ... ... | 98—103 | ... | ... |
| 65,000 | ,, | Aug. 9 | 8½ | 7½ | Eastbourne 'A' 5 p.c. ... | 158—163 | ... | ... |
| 198,000 | ,, | ,, | 7 | 6 | Do. 'B' 3½ p.c. ... ... | 128—133 | ... | ... |
| 112,312 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 108—113 | ... | ... |
| 130,000 | ,, | June 21 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 115—120 | ... | ... |
| 24,000 | 30 | Aug. 23 | 8½ | 8½ | Great Yarmouth 8½ p.c. max. | 44—49* | ... | ... |
| 59,400 | 30 | ,, | 7½ | 7½ | Do. 7½ p.c. max. ... ... | 44—49* | ... | ... |
| 51,160 | Stk. | June 7 | 5½ | 5½ | Do. 5½ p.c. Deb.... ... | 120—125 | ... | ... |
| 152,600 | ,, | Feb. 15 | 8 | 9 | Guildford Cons. ... ... | 172—177 | ... | ... |
| 54,055 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 112—117 | ... | ... |
| 68,250 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 113—118 | ... | ... |
| 156,600 | ,, | Aug. 23 | 7½ | 7½ | Hampton Court Cons. ... | 158—163* | ... | 160—161 |
| 73,620 | ,, | Mar. 15 | 8½ | 8½ | Luton Cons. 'A' ... ... | 166—171 | ... | ... |
| 107,960 | 10 | Mar. 15 | 4 | 5½ | Mid Kent Ord. ... ... | 9—10 | ... | ... |
| 230,940 | Stk. | Aug. 9 | 10 | 10 | Oxford & District Ord. ... | 203—208 | ... | 209½—210 |
| 47,112 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 108—113 | ... | ... |
| 50,000 | ,, | ,, | 6 | 6 | Do. 6 p.c. Red. Pref. ... | 110—115 | ... | ... |
| 126,193 | ,, | May 3 | 7½ | 7½ | Peterborough Ord. ... ... | 159—169 | ... | ... |
| 64,990 | ,, | Mar. 15 | 6½ | 7½ | Redditch Ord. ... ... | 127—137 | ... | ... |
| 166,850 | ,, | Aug. 9 | 8 | 8 | Romford Ord. ... ... | 155—165 | ... | ... |
| 60,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. ... ... | 97—100 | ... | ... |
| 44,000 | ,, | Mar. 15 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 115—120 | ... | ... |
| 25,570 | ,, | Aug. 9 | 5½ | 5½ | Rugby 5½ p.c. Pref. ... | 125—130 | ... | ... |
| 25,000 | ,, | ,, | 6 | 6 | Do. 6 p.c. Red. Pref. ... | 106—111 | ... | ... |
| 42,750 | ,, | June 7 | 5½ | 5½ | Do. 5½ p.c. Deb. ... ... | 122—127 | ... | ... |
| 10,950 | ,, | Aug. 23 | 8 | 8 | Ryde Ord. ... ... ... | 158—163* | ... | ... |
| 136,191 | ,, | Aug. 9 | 7 | 5 | Scarborough Ord. ... ... | 115—125 | ... | ... |
| 27,825 | ,, | Aug. 23 | 8 | 8 | Shanklin & Ventnor Cons. ... | 158—168* | ... | ... |
| 270,086 | ,, | Mar. 15 | 7 | 7 | Slough Ord. ... ... ... | 137—142 | ... | ... |
| 21,000 | ,, | June 21 | 5 | 5 | Do. 5 p.c. Deb.... ... | 112—117 | ... | ... |
| 28,872 | 1 | May 24 | 5½ | 5½ | S. Midland Gas Cpn. Ltd. Ord. | 19/—21/- | ... | ... |
| 28,866 | 1 | Mar. 15 | 4½ | 4½ | Do. 4½ p.c. Red. Cum. Pref. | 18/6—20/6 | ... | ... |
| 137,730 | Stk. | Aug. 9 | 7 | 7 | Southgate & Dist. 7 p.c. max. | 140—145 | ... | ... |
| 62,500 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 110—115 | ... | ... |
| 117,228 | ,, | Aug. 23 | 5 | 5 | Swindon Cons. ... ... | 106—111* | ... | ... |
| 60,425 | ,, | June 7 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 110—115 | ... | ... |
| 64,380 | ,, | June 7 | 5 | 5 | Torquay and Paignton 5 p.c. Pf | 110—115 | ... | ... |
| 130,000 | ,, | Aug. 9 | 8 | 5 | Wakefield Ord. ... ... | 120—125 | ... | ... |
| 81,650 | ,, | ,, | 5 | 5 | Do. 5 p.c. max. ... ... | 103—108 | ... | ... |
| 82,000 | ,, | Aug. | 6 | 6 | Weymouth Ord. ... ... | 103—108 | ... | ... |
| 98,384 | ,, | Aug. 9 | 6 | 6 | Wolverhampton 6 p.c. Pref.... | 125—130 | ... | ... |
| 160,000 | ,, | June 21 | 5½ | 5½ | Do. 5½ p.c. Rd. Db | 108—113 | ... | ... |
| 370,000 | ,, | Aug. 9 | 6 | 4 | York Cons. ... ... ... | 102—107 | ... | ... |
| 90,000 | ,, | June 21 | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 105—110 | ... | ... |
| 133,640 | ,, | July 19 | 6½ | 6½ | Yorktown (Cam.) 5 p.c Cons. | 128—133 | ... | ... |
| 120,000 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 108—113 | ... | ... |
| 35,000 | ,, | June 7 | 5½ | 5½ | Do. 5½ p.c. Deb.... ... | 123—128 | ... | ... |

a The quotation is per £1 of Stock. b Actual for Quarter. * Ex div.


# DOMESTIC UTILIZATION of GAS

SMITH & LeFEVRE

**PART 1.**—A new and completely revised edition. In five years since the First Edition many developments have taken place in the Industry; and these are given their full weight in a work which has already proved of the utmost value to thousands, and is officially recommended by Teachers and Lecturers at many centres.

**PROPERTIES OF TOWN GAS — PRESSURE, SPECIFIC GRAVITY, TEMPERATURE, FLOW — GOVERNORS, METERS, HOUSE PIPES — GAS FLAMES AND BURNERS — VENTILATION — COOKING — WATER HEATING — SPACE HEATING — REFRIGERATION — LIGHTING.**

156 **5/6** Pages.

**PART 2.**—In common with its forerunner, Part 2 is noteworthy for the Authors' originality of approach, facility of expression, and, above all, intimate knowledge of the problems which confront the gas salesman. *Part 2 of "Domestic Utilization of Gas" is a corollary to, and in no way a revision of, Part 1.*

**COMBUSTION — GAS RATE CONTROL — WATER-HEATING LOAD—REFRIGERATION —INFERENTIAL MEASUREMENT OF GAS.**

136 **5/6** Pages.

**24 Copies and over at 5/- each**

WALTER KING, LTD.,
11, Bolt Court, Fleet Street,
London, E.C. 4

# CONTENTS

**EDITORIAL NOTES.**

Flexibility in the Gas Industry . . . . . 655
William Young Memorial Lecture . . . . 655
Research at East Greenwich . . . . . 656
A Challenge . . . . . 656
New Plant at Copenhagen . . . . . 657
Benzole in New Zealand . . . . . 657
Stockholders' Interest . . . . . 658

Personal . . . . . 658
Obituary . . . . . 658
British Commercial Gas Association—Programme for Annual Conference . . . . 659
In this Week's "JOURNAL" . . . . . 659
News in Brief . . . . . 660

Amalgamation and Grouping—
Severn Valley and Caldicot . . . . . 660
Torquay and Paignton and Totnes and Bridgetown . . . . . 660
United Kingdom and Ellesmere Port . . 660

Severn Valley Gas Corporation—Increased Interim Dividend Announced . . . . 660

High "Beam" Gas Fires—Richmonds' New Lists . . . . . 661

British Standards Institution—Specification for Sampling and Analysis of Coal and Coke for Test Trials . . . . . 661

Forthcoming Engagements . . . . . 661

New Gas Plant Inaugurated at Copenhagen . 662

Gas Pre-Eminent at the Bakers' and Confectioners' Exhibition . . . . . 665

A New House Organ—The *Cambridge Gas Bulletin* . . . . . 666

North British Association of Gas Managers—
Annual Meeting at Edinburgh . . . . 667
Civic Luncheon . . . . . 668
Evening Reception . . . . . 669
Golf and Bowls Competitions . . . . 669
Flexibility and Balance in the Gas Industry. By J. G. King, Ph.D., A.R.T.C., F.I.C. . 670

Gas Undertakings' Results . . . . . 669, 695

Trade Notes . . . . . 683

Experiments by the South Metropolitan Gas Company on the Preparation of Thin Tar Carpets . . . . . 684

Association of Public Lighting Engineers—
Annual Conference at Folkestone . . . 689
Entertained by the Gas Light and Coke Company . . . . . 689
Annual Dinner . . . . . 691
Discussions at the Conference . . . . 691

Gas Markets and Manufactures—
Stock Market Report . . . . . 695
Current Sales of Gas Products . . . . 695
Contracts Advertised To-Day . . . . 695
Overseas Opportunities . . . . . 695

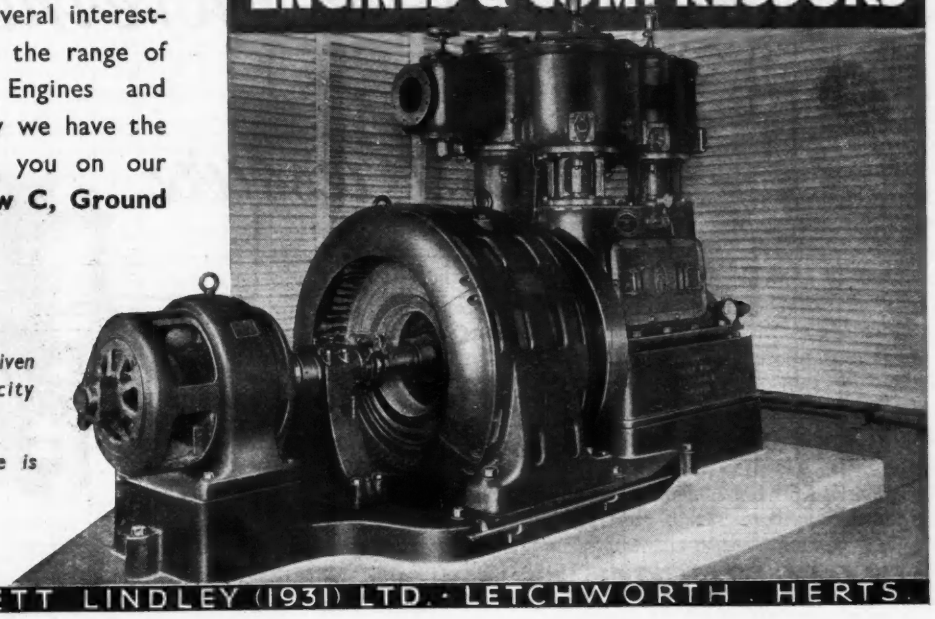
Stock and Share Lists . . . . . 697–98

**For Advertisers' Index see PAGE 651.**

**ENGINEERING & MARINE EXHIBITION**

**BROWETT-LINDLEY ENGINES & COMPRESSORS**

We are showing several interesting examples from the range of Browett - Lindley Engines and Compressors. May we have the pleasure of seeing you on our **Stand No. 4. Row C, Ground Floor?**



*Typical BL Motor Driven Compressor. Capacity 750 cu. ft. per minute.*

*A machine of this size is being shown.*

J. BROWETT LINDLEY (1931) LTD. · LETCHWORTH . HERTS.

Soanes B/527

THOMAS GLOVER & CO. LTD.

EDMONTON. LONDON N.18 and BRANCHES